CENTRAL BANKS AND REGULATION OF CRYPTOCURRENCIES

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This paper has been prepared by the authors under the Legal Research Programme sponsored by the ECB. Any views expressed are only those of the authors and do not necessarily represent the views of the ECB or the Eurosystem.

Abstract: *This Paper explores the interface between central banks and cryptocurrencies. Focusing on the European Central Bank (ECB), it identifies the potential threats that the rise of cryptocurrencies would pose to the basic and ancillary tasks of the ECB—in particular, its monetary policy operations and the exercise of its supervisory functions over credit institutions and payment systems. The Article finds that cryptocurrencies can potentially have both direct (through their potential impact on price stability, monetary policy, and central banks' monopoly over issuing base money) and indirect effects on central banks (mainly through the institutions and systems that fall under the ECB's scope of competence).*

To address the challenges posed by cryptocurrencies, the ECB may take both legal (including supervisory and oversight) measures and non-legal (or technical) measures. With respect to technical measures, the ECB—to the extent falling within the scope of its competence—may focus on improving the efficiency of existing payment systems and addressing the existing frictions in market infrastructures to indirectly affect the cryptocurrency markets. Alternatively, it can venture into issuing Central Bank Digital Currency (CBDC). Regarding legal measures, central banks could envisage regulating cryptocurrencies either directly or indirectly. However, as the most significant potential impact of cryptocurrencies on central banks is likely to be indirect through the impact of cryptocurrencies on the banking and payment systems, and given the limitations on the ECB's mandate and its regulatory and supervisory tools, it is apposite for the ECB to consider using indirect strategies and tools to influence cryptocurrency markets. This indirect approach can be implemented through the

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ECB's existing supervisory and oversight powers over the banking and payment systems. This Article specifies the direct and indirect measures and assesses their merits in addressing the concerns about cryptocurrencies.

Keywords: *Central bank, European Central Bank, Cryptocurrency, Bitcoin, Money, Regulation*

JEL classification: *E42, E51, E58, G01, G23, G28, K22, K23, K24*

Introduction

Cryptocurrencies are financial technology (fintech) innovations. Similar to most financial innovations, cryptocurrencies are driven by a desire to reduce transaction costs, facilitate risk management, complete incomplete markets by addressing agency costs arising from information asymmetry, and circumvent taxes and regulations or engage in regulatory arbitrage.[1] Despite the much-touted economic, political, and ideological motivations behind the creation of cryptocurrencies,[2] they have emerged to address market frictions. One such friction was the lack of a global, un-censorable peer-to-peer (P2P) digital payment mechanism.[3] One of the major challenges to the emergence of such a mechanism has been the double-spending problem.[4] Prior to bitcoin, the task of addressing this problem was delegated to trusted

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[1] Binghui Wu & Tingting Duan, *The Advantages of Blockchain Technology in Commercial Bank Operation and Management*, 4 INT'L CONF. MACH. LEARNING TECHS. 83, 86–87 (2019) (discussing how the application of blockchain technology in bill operation can lower risks as well as reduce transaction cost and time).

[2] For background information, *see* NATHANIEL POPPER, DIGITAL GOLD: BITCOIN AND THE INSIDE STORY OF THE MISFITS AND MILLIONAIRES TRYING TO REINVENT MONEY (Harper 2015) (discussing generally the motivations behind the creations of cryptocurrencies); Michael D. Bordo & Andrew T. Levin, *Central Bank Digital Currency and the Future of Monetary Policy* 1 (Hoover Inst., Econ. Working Paper No. 17104, 2017) (outlining the basic design characteristics of central bank digital currency); NICK BILTON, AMERICAN KINGPIN: THE EPIC HUNT FOR THE CRIMINAL MASTERMIND BEHIND THE SILK ROAD (2017) (exploring the role of cryptocurrency in transactions on the Dark Web).

[3] SATOSHI NAKAMOTO, BITCOIN: A PEER-TO-PEER ELECTRONIC CASH SYSTEM 1, 1 (2008) ("Commerce on the Internet has come to rely almost exclusively on financial institutions serving as trusted third parties to process electronic payments. While the system works well enough for most transactions, it still suffers from the inherent weaknesses of the trust based model.").

[4] M. Padmavathi & R.M. Suresh, *Secure P2P Intelligent Network Transaction Using Litecoin,* 24 MOBILE NETWORKS & APPLICATIONS 318, 320 (2019) ("To attain information about Litecoin P2P network, we took a well acknowledged approach in the inquiry related to P2P networks as discussed in [19, 24]. This method establishes Litecoin P2P network to prevent its users against double spending attack, faster transaction than Bitcoin network, and to attain higher profitability.")

third parties in charge of centralized ledgers.[5] Bitcoin solved the double-spending problem in a highly secure,[6] decentralized, consensus-based, and censorship-resistant manner, replacing the traditional trusted third parties with cryptographic proof and affording users the optionality of pseudonymity and anonymity.[7]

The underlying technology of cryptocurrencies and associated markets can pose risks to monetary and financial systems.[8] Some of

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[5] For an overview of early attempts to solve this problem, *see* Aaron van Wirdum, *The Genesis Files: If Bitcoin Had a First Draft, Wei Dai's B-Money Was It*, BITCOIN MAGAZINE (June 15, 2018), https://bitcoinmagazine.com/articles/genesis-files-if-bitcoin-had-first-draft-wei-dais-b-money-was-it (discussing how the second b-money solution solved the double-spending problem by adding "servers"); Aaron van Wirdum, *The Genesis Files: How David Chaum's eCash Spawned a Cypherpunk Dream*, BITCOIN MAGAZINE (April, 24 2018), https://bitcoinmagazine.com/articles/genesis-files-how-david-chaums-ecash-spawned-cypherpunk-dream. ("Alice Bank also checks that the same banknotes (serial numbers) haven't already been deposited by someone else in order to ensure that they haven't been double-spent."); Aaron van Wirdum, *The Genesis Files: Hashcash or How Adam Back Designed Bitcoin's Motor Block*, BITCOIN MAGAZINE (June 4, 2018), https://finance.yahoo.com/news/genesis-files-hashcash-adam-back-130523132.html. ("This is how, in Bitcoin, Hashcash killed two birds with one stone. It solved the double-spending problem in a decentralized way, while providing a trick to get new coins into circulation with no centralized issuer.").

[6] Thus far, Bitcoin has proved to be one of the most secure financial networks. Other blockchain-based cryptocurrencies may prove less secure. For example, more recently, there have been a few successful 51% attacks to double-spend on some cryptocurrencies such as Verge, Bitcoin Gold, MonaCoin and more recently on Ethereum Classic. *See* Cali Haan, *Verge, Bitcoin Gold and MonaCoin Hacked*, CROWDFUND INSIDER (May 25, 2018, 7:41 AM), https://www.crowdfundinsider.com/2018/05/133936-verge-bitcoin-gold-and-monacoin-hacked [https://perma.cc/MT87-4PNT] ("Hackers have successfully executed attacks on three cryptocurrency blockchains in the past week. Verge, Bitcoin Gold and MonaCoin were all robbed of coins in the attacks … Bitcoin Gold, a coin generated as a hard fork of Bitcoin to supposedly resist mining centralization, was hit with a significant "double spend" attack around May 16th. "To execute the attack, the miner acquired at least 51 percent of the network's total hashpower, which provided them with temporary control of the blockchain. …"').

[7] SATOSHI, *supra* note 6, at 6 (discussing privacy aspects characteristics of Bitcoin).

[8] *See, e.g.*, Robert Stokes, *Virtual Money Laundering: The Case of Bitcoin and the Linden Dollar*, 21 INFO. & COMM. TECH. L. 221, 221–22 (2012) ("This paper presents an analysis of the money laundering risks of two virtual

these risks include concerns about fraud,[9] market manipulation,[10] financial crime,[11] consumer protection,[12] liability issues in distributed ledgers,[13] the development of large closed networks that can poten-

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currencies, the Linden dollar, the in-world currency of the interactive online environment Second Life, and Bitcoin, an experimental virtual currency that allows for the transfer of value through peer-to-peer software.").

[9] MASSIMO BARTOLETTI ET AL., DISSECTING PONZI SCHEMES ON ETHEREUM: IDENTIFICATION, ANALYSIS, AND IMPACT 28 (Aug. 14, 2019), https://arxiv.org/pdf/1703.03779.pdf [https://perma.cc/2HYN-P6VC] ("Blockchains and smart contracts might really be the next 'disruptive' technologies, as often reported by the media; however, they can also offer new opportunities to tax-evaders, criminals, and fraudsters, who can take advantage of their anonymity and decentralization."); FSC MAJORITY COMM. STAFF, FULL COMMITTEE HEARING ON THE ANNUAL REPORT OF THE FINANCIAL STABILITY OVERSIGHT COUNCIL, 2 (Sept. 19, 2016) (showcasing the government's concerns about cybersecurity disrupting financial stability); HYMAN P. MINSKY, STABILIZING AN UNSTABLE ECONOMY 377 (McGraw-Hill ed., Yale Univ. Press 2008) (1986) (providing a definition of ponzi scheme).

[10] *Quantifying the Effect of Tether*, (Jan. 24, 2018), https://www.tetherreport.com/ [https://perma.cc/2PT7-RRHR] (discussing red flags and the potential for coordinated market manipulation); John M. Griffin & Amin Shams, *Is Bitcoin Really Un-Tethered?* 2 (SSRN Working Paper Series, Oct. 28, 2019), https://ssrn.com/abstract=3195066 ("Trading on unregulated exchanges, and specifically on cross-digital-currency exchanges, could leave cryptocurrencies vulnerable to gaming and manipulation.").

[11] Kim-Kwang Raymond Choo, *Cryptocurrency and Virtual Currency: Corruption and Money Laundering/Terrorism Financing Risks?*, *in* HANDBOOK OF DIGITAL CURRENCY: BITCOIN, INNOVATION, FINANCIAL INSTRUMENTS, AND BIG DATA 283, 303 (David Lee Kuo Chuen ed., 2015) (illuminating potential issues concerning financial crime); Robert Stokes, *supra* note 8, at 224 (discussing the relationship between Bitcoin and money laundering); *see also* OFFICE OF THE N.Y STATE ATTORNEY GEN., VIRTUAL MARKETS INTEGRITY INITIATIVE REPORT (Sept. 18, 2018) ("[H]ackers have infiltrated trading platforms and stolen billions of dollars worth of virtual currency, leaving customres with little or no recourse.").

[12] Dong He et al., *Virtual Currencies and Beyond: Initial Considerations* 1, 28-30 (Jan. 2016) [hereinafter *Virtual Currencies and Beyond*], https://www.imf.org/external/pubs/ft/sdn/2016/sdn1603.pdf [https://perma.cc/RWB3-VTNS] (illuminating a number of consumer protection concerns).

[13] Dirk A Zetzsche et al., *The Distributed Liability of Distributed Ledgers: Legal Risks of Blockchain*, 2018 U. ILL. L. REV. 1361, 1369 (2017) ("As these examples show, risk does not vanish if financial services are provided via distributed ledgers.").

tially create barriers to entry,[14] data protection, taxation policy for cryptocurrencies,[15] monetary policy,[16] and financial stability.[17] Further future challenges may include a lack of common standards and interoperability, governance issues,[18] privacy concerns,[19] scalability,[20] and

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[14] Dong He et. al., *Fintech and Financial Services: Initial Considerations*, 1, 5 (June 2017) https://www.imf.org/external/pubs/ft/sdn/2016/sdn1603.pdf [https://perma.cc/9C44-Z4CA] [hereinafter *Fintech and Financial Services: Initial Considerations*] ("Barriers to entry are changing, being lowered in some cases but increased in others, especially if the emergence of large closed networks reduces opportunities for competition.").

[15] Aleksandra Bal, *How to Tax Bitcoin?*, *in* HANDBOOK OF DIGITAL CURRENCY: BITCOIN, INNOVATION, FINANCIAL INSTRUMENTS, AND BIG DATA 267, 276 (David Lee Kuo Chuen ed., 2015) ("Without effective supervision and enforcement, thereis a risk of nontaxation that threatens to distort competition.").

[16] Christine Lagarde, IMF Managing Dir., Central Banking and Fintech—A Brave New World? (Sept. 29, 2017) ("So in many ways, virtual currencies might just give existing currencies and monetary policy a run for their money.").

[17] COMM. ON PAYMENTS AND MRT. INFRASTRUCTURES, DIGITAL CURRENCIES 15–16 (Nov. 2015), https://www.bis.org/cpmi/publ/d137.pdf [https://perma.cc/5ZS3-3H4D] [hereinafter DIGITAL CURRENCIES] (discussing the implications on financial stability, such as financial market infrastructures).

[18] Hossein Nabilou, *Bitcoin Governance as a Decentralized Financial Market Infrastructure*, SSRN WORKING PAPER SERIES (2020). https://dx.doi.org/10.2139/ssrn.3555042; Aaron van Wirdum, *A Primer on Bitcoin Governance, or Why Developers Aren't in Charge of the Protocol*, BITCOIN MAG. (Sept. 7, 2016), https://bitcoinmagazine.com/articles/a-primer-on-bitcoin-governance-or-why-developers-aren-t-in-charge-of-the-protocol-1473270427 [https://perma.cc/Y4V2-HHMA] (discussing the governance of Bitcoin) [hereinafter *A Primer on Bitcoin Governance*].

[19] Primavera De Filippi, *The Interplay between Decentralization and Privacy: The Case of Blockchain Technologies*, J. PEER PRODUCTION (2016), http://peerproduction.net/editsuite/issues/issue-9-alternative-internets/peer-reviewed-papers/the-interplay-between-decentralization-and-privacy-the-case-of-blockchain-technologies/ [https://perma.cc/L6E4-2QFA] (illustrating the implications of blockchain technologies for individual privacy).

[20] EUROPEAN SEC. & MKTS. AUTH., REPORT: THE DISTRIBUTED LEDGER TECHNOLOGY APPLIED TO SECURITIES MARKETS 2 (2017) (outlining challenges related to the distributed ledger technology including "interoperability and the use of common standards, access to central bank money, governance and privacy issues and scalability"); *see also* HUW VAN STEENIS ET AL., GLOBAL INSIGHT: BLOCKCHAIN IN BANKING: DISRUPTIVE THREAT OR TOOL? MORGAN STANLEY RES. 11 (2016), https://hub.digitalasset.com/hubfs/Industry%20Reports/morgan-stanley-report.pdf [https://perma.cc/DN9K-N98K] ("In some

potential risks in the issuance of central bank digital currency (CBDC) or digital base money (DBM).[21]

Such challenges, together with cryptocurrencies' price volatility and the uncertainly about their legal nature as to whether they are a medium of exchange,[22] investment,[23] or access,[24] prompted a lively debate about cryptocurrencies among various regulators such as financial crime enforcement agencies and banking, securities, and commodity markets regulators.[25] However, the main focus of such studies was on the potential risks and rewards of using distributed ledger technologies (DLTs), blockchain technology, and cryptocurrencies.[26] Various studies by several national and regional authorities, as well as international organizations, such as the US Federal Reserve

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implementations of blockchain, including Bitcoin, scalability challenges have already become evident, or at least well anticipated.").

[21] *See* Aleksander Berentsen & Fabian Schär, *The Case for Central Bank Electronic Money and the Non-case for Central Bank Cryptocurrencies*, 100 FED. RES. BANK ST. LOUIS REV. 97, 99–104 (2018) [hereinafter *Central Bank Electronic Money*] (comparing arguments and counterarguments for central bank electronic money); Yves Mersch, Member of the Executive Board of the European Central Bank, Digital Base Money: an assessment from the European Central Bank's perspective, Speech at the Farewell ceremony for Mr. Pentti Hakkarainen, Deputy Governor of the Bank of Finland (Jan. 16, 2017) (elaborating on the issues related to "Central Bank Digital Currency, or Digital Base Money (DBM)"); *see also* Morgan Ricks, *Money as Infrastructure*, 2018 COLUM. BUS. L. REV. 757, 814 (2018) (observing the development of the shadow banking system and its cash equivalent instruments).

[22] Primarily known as "cryptocurrencies"; *see* Jake Frankenfield, *Cryptocurrency*, INVESTOPEDIA (last updated Nov. 3, 2019) https://www.investopedia.com/terms/c/cryptocurrency.asp) [https://perma.cc/W8CT-SDR3] (defining cryptocurrency).

[23] Also known as "security tokens"; *see* Rajarshi Mitra, *Utility Tokens vs Security Tokens: Learn The Difference—Ultimate Guide*, BLOCKGEEKS, (last visited Apr. 2, 2020) https://blockgeeks.com/guides/utility-tokens-vs-security-tokens/ [https://perma.cc/JZF7-DYJ9] (explaining security tokens and their differences from utility tokens).

[24] Also known as "utility tokens." *Id.* (explaining utility tokens and their differences from security tokens).

[25] EUROPEAN SEC. & MKTS. AUTH., *supra note* 20, at 2 ("The distributed ledger technology ('DLT') has quickly caught the attention of many in finance for its potential to streamline financial processes and to save costs.")

[26] *Advice of the European Securities and Markets Authority on Initial Coin Offerings and Crypto-Assets*, at 4 (Jan. 9, 2019) (giving a brief overview of how "cryptocurrencies" will be reviewed in the article).

and its regional banks,[27] the European Central Bank (ECB),[28] the European Banking Authority (EBA),[29] the International Monetary Fund (IMF),[30] and the Bank for International Settlements (BIS)[31] have

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[27] DAVID MILLS ET AL., FIN. AND ECON. DISCUSSION SERIES NO. 2016-095, DISTRIBUTED LEDGE TECHONOLOGY IN PAYMENTS, CLEARING, AND SETTLEMENT 3 (2016) (analyzing the various benefits and drawbacks of cryptocurrencies); Aleksander Berentsen & Fabian Schär, *A Short Introduction to the World of Cryptocurrencies*, FED. RES. BANK OF ST. LOUIS REV., Mar. 2018, at 1–16 (providing an overview of cryptocurrencies, starting with Bitcoin, and some of the pros and cons associated with them); *Central Bank Electronic Money*, *supra* note 21, at 97–106 (providing an analysis of the benefits and draw backs of the control structre of cryptocurrencies); Gina C. Pieters, *The Potential Impact of Decentralized Virtual Currency on Monetary Policy*, FED. RES. BANK OF DALLAS GLOBALIZATION AND MONETARY POL'Y INST. 2016 ANN. REP. 20 (Jan. 1, 2017) (explaining the potential impact decentralized virtual currencies can have on the administration of monetary policy); Alexander Kroeger & Asani Sarkar, *Is Bitcoin Really Frictionless?*, LIBERTY STREET ECON. (Mar. 23, 2016), [https://perma.cc/TZH7-2JX5] (examining the the benefits and drawbacks of Bitcoin and virtual currencies in general).

[28] EUR. CENT. BANK, VIRTUAL CURRENCY SCHEMES 33 (2012) https://perma.cc/U2D2-J3JM] [hereinafter VIRTUAL CURRENCY SCHEMES] (explaining that the document will focus on providing clarity on virtual currencies); EUR. CENT. BANK, VIRTUAL CURRENCY SCHEMES — A FURTHER ANALYSIS 4 (Feb. 2015) [hereinafter A FURTHER ANALYSIS] (briefly giving an overview of how the paper will address "virtual currencies"); *European Central Bank on The Potential Impact of DLTs on Securities post-Trading Harmonization and on the Wider EU Financial Market Integration*, at 8 (Sept. 2017) (outlining how the paper will treat distributed ledger technologies, the technology behind cryptocurrencies); *see also European Central Bank Occasional Paper Series on Distributed Ledger Technologies in Securities Post-Trading*, at 3 (Apr. 2016) (provides an overview of how the paper will analyze the new distributed ledger technologies and their impact on the securities markets).

[29] *Opinion of the European Banking Authority on "virtual currencies"*, at 10 (July 4, 2014) (giving a brief overview of the report on the risks and rewards of virtual currencies).

[30] *Virtual Currencies and Beyond: Initial Considerations*, *supra* note 12, at 5, SDN/16/03 (giving an overview of how it will analyze the potential benefits and risks of virtual currencies).

[31] Morten Bech & Rodney Garratt, *Central Bank Cryptocurrencies*, BANK FOR INT'L SETTLEMENTS Q. REV., at 55 (Sept. 2000) (explaining that one of the questions the article attempts to answer is where central bank cryptocurrencies will be useful); DIGITAL CURRENCIES, *supra* note 17, at 4–7 (providing an overview of the key aspects of digital currencies); *Cryptocurrencies:*

been conducted on the costs and benefits of cryptocurrencies. Furthermore, the literature on the monetary and financial dimensions of cryptocurrencies with respect to central banking has become extensive.[32] However, the legal aspects of cryptocurrencies from a central banking perspective remain under-investigated.

Looking Beyond the Hype, BANK FOR INT'L SETTLEMENTS ANN. ECON. REP. 91 (2018) (reviewing the emergence of cryptocurrencies and their benefits).

[32] SAHIL GUPTA & JOAN FEIGENBAUM, *FEDCOIN: A BLOCKCHAIN-BACKED CENTRAL BANK CRYPTOCURRENCY* 4 (Yale Univ. Press, 2017) (reviewing the possiblity of having a "Fedcoin", a cryptocurrency that is used by the central bank); David Andolfatto, *Fedcoin: On the Desirability of a Government Cryptocurrency*, MACROMANIA BLOG (Feb. 03, 2015, 11:38 AM), http://andolfatto.blogspot.com/2015/02/fedcoin-on-desirability-of-government.html [https://perma.cc/5GAF-LXE7] (discussing the desirability of using cryptography to create a government cryptocurrency); JP Koning, *Moneyness: Fedcoin*, THE BLOG OF JP KONING (Oct. 19, 2014, 1:28 PM), http://jpkoning.blogspot.com/2014/10/fedcoin.html [https://perma.cc/V3DK-59D8] (making the case for a fedcoin and discussing the viability of cryptocurrency technology to be used by central banks); Larry White, *The World's First Central Bank Electronic Money Has Come—And Gone: Ecuador, 2014-2018*, ALT-M (Mar. 29, 2018), https://www.alt-m.org/2018/03/29/the-worlds-first-central-bank-electronic-money-has-come-and-gone-ecuador-2014-2018/ [https://perma.cc/GP6S-GRC9] (explaining how central banks can use electronic money, by giving an example of one country that has—Ecuador); John Barrdear & Michael Kumhof, *The Macroeconomics of Central Bank Issued Digital Currencies* (Bank of Eng., Staff Working Paper No. 605, 2016), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2811208 (explaining how central banks can use "CBDC" or central bank digital currency); Bordo & Levin, *supra* note 2 (explaining how central banks can use "CBDC" or central bank digital currency); Michael Kumhof & Clare Noone, *Central Bank Digital Currencies Design principles and balance sheet implications 4*, (Bank of Eng., Staff Working Paper No. 725, 2018), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3180713 (explaining how central banks can use "CBDC" or central bank digital currency); Jack Meaning et al., *Broadening Narrow Money: Monetary Policy with a Central Bank Digital Currency 4* (Bank of Eng. Staff Working Paper No. 724 2018), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3180720 (explaining how central banks can use "CBDC" or central bank digital currency); Eswar Prasad, *Central Banking in a Digital Age: Stock-Taking and Preliminary Thoughts*, 14 (Brookings Inst., Working Paper, Apr. 2018), https://www.brookings.edu/wp-content/uploads/2018/04/es_20180416_digitalcurrencies.pdf. (exploring how technological changes, such as cryptography, are likely to affect the practice of central banking); Bech & Garratt, *supra* note 31, at 57 (examining the possibility of cryptocurrency being used by central banks); *Central Bank Electronic Money*, *supra*

To attain that objective, this Article seeks to study the relevance of cryptocurrencies to central banks, and specifically the ECB. It argues that since developments in the cryptocurrency ecosystem directly or indirectly involve the ECB's basic tasks and other functions, there is ground for ECB intervention based on its mandate enshrined in articles 127[33] and 128[34] of the Treaty on the Functioning of the European Union (TFEU) and Article 3 of the Protocol (no 4)[35] on the Statute of the European System of Central Banks and of the European Central Bank (hereinafter, ESCB/ECB Statute). The Article proceeds as follows. First, it sets the groundwork for analysis by classifying the effects of cryptocurrencies on central banking and linking them to the mandate and competences of the ECB.[36] Second, it discusses the impact of cryptocurrencies on monetary policy and price stability by drawing parallels between different forms of fiat money and cryptocurrencies.[37] As price stability is the primary objective of the ECB's monetary policy any impact on price stability would justify the direct involvement of the ECB in cryptocurrency markets.[38] In the third section, the Article discusses the policy options of the ECB.[39] Having found that the direct involvement of the ECB in cryptocurrency markets would not be desirable, in the subsequent three sections, the Article explores the impact on payment systems,[40]banking systems,[41] and financial stability respectively,[42] and argues that the best strategy for regulating cryptocurrency markets is through the existing

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note 21, at 99 (exploring the case for cryptocurrencies being used as a form of central bank electronic money).

[33] Consolidated Version of the Treaty on the Functioning of the European Union, art. 127, May 9, 2008, 2008 O.J (C 115) 102 [hereinafter TFEU Article 127].

[34] Consolidated Version of the Treaty on the Functioning of the European Union, art. 128, Mar. 30, 2010, 2010 O.J (C 83) 103 [hereinafter TFEU Article 128].

[35] Commission Protocol No. 4, 2012 O.J. (C 326) 230.

[36] *See infra* Part I.

[37] *See infra* Part II.

[38] Consolidated Version of the Treaty on the Functioning of the European Union art. 127(1), July 6, 2016, 2016 O.J. (C 202) 102 ("The primary objective of the European System of Central Banks (hereinafter referred to as 'the ESCB') shall be to maintain price stability.").

[39] *See infra* Part III.

[40] *See infra* Part IV.

[41] *See infra* Part V.

[42] *See infra* Part VI.

regulatory, supervisory, and oversight powers of the ECB over banking and payment systems. The seventh section further explores the legal aspects of issuing CBDC, as an indirect technical intervention.[43] Finally, after exploring the venues for policy coordination at the international level, the Article presents a few concluding remarks.[44]

I. Cryptocurrencies and the ECB: Direct and Indirect Links

Despite a decade-long struggle to gain traction, the jury is still out on the success of cryptocurrency experiments.[45] If the popularity of cryptocurrencies passes a certain tipping point, they could pose threats to the financial system with a direct impact on central banks both in their monetary policy, supervisory, and oversight capacity.[46] Some of these challenges would pose threats to the activities, financial market infrastructures (FMIs), and entities that fall within the scope of ECB's basic tasks and other functions.[47]

According to Article 127(1) of the TFEU and Article 2 of the ESCB/ECB Statute, maintaining price stability is the primary objective of the European System of Central Banks (ESCB).[48] The functions of

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[43] *See infra* Part VII.

[44] *See infra* Conclusion.

[45] Susan Alkadri, *Defining and Regulating Cryptocurrency: Fake Internet Money or Legitimate Medium of Exchange*, 17 DUKE L. & TECH. REV. 71, 71–73 (2018) (providing a general overview of the strengths and weaknesses of cryptocurrency).

[46] *Id.* at 73 ("[R]egulators are … wary of this technology" because of the increased potential for risk of "misinformed investments, market fraud and manipulation, [and] destabilization of the global economy.").

[47] *Id.*

[48] Consolidated Version of the Treaty on the Functioning of the European Union art. 127(1), July 6, 2016, 2016 O.J. (C 202) 102 ("The primary objective of the European System of Central Banks (hereinafter referred to as 'the ESCB') shall be to maintain price stability."); Protocol (No. 4) on the Statute of the European System of Central Banks and of the European Central Bank art. 2, 2016 O.J. (C 202) 230 [hereinafter ESCB/ECB Statute] ("In accordance with Article 127(1) and Article 282(2) of the Treaty on the Functioning of the European Union, the primary objective of the ESCB shall be to maintain price stability. Without prejudice to the objective of price stability, it shall support the general economic policies in the Union with a view to contributing to the achievement of the objectives of the Union as laid down in Article 3 of the Treaty on European Union."). This is why some commentators have referred to the ECB as a single mandate central bank. There have been calls to change the mandate of the ECB. *See, e.g.*, JOSEPH E. STEGLITZ, THE EURO: HOW A

the ESCB include basic tasks[49] and other functions (non-basic or ancillary tasks).[50] The ESCB's basic tasks include defining and implementing the monetary policy of the EU, conducting foreign-exchange operations, holding and managing the official foreign reserves of the Member States, and promoting the smooth operation of payment systems.[51] The non-basic or ancillary tasks of the ESCB include issuance of banknotes,[52] contribution to the prudential supervision of credit institutions and stability of the financial system,[53] advisory functions,[54]

COMMON CURRENCY THREATENS THE FUTURE OF EUROPE 256–57 (2016) (arguing that the ECB should change its mandate to embrace promoting full employment and healthy financial growth as one of its basics tasks, in addition to merely managing inflation).

[49] *See* TFEU art. 127(2) (defining the "basic tasks" of the ESCB as crafting and implementing the monetary policy of the EU; conducting foreign-exchange operations; holding and exchanging the official foreign reserves of the Member States; and promoting the smooth operation of payment systems in the EU); ESCB/ECB Statute art. 3.1 (recapitulating the main tasks of the ESCB in language identical to Article 127(2) of the TFEU).

[50] ROSA MARIA LASTRA, INTERNATIONAL FINANCIAL AND MONETARY LAW 255 (2015) ("The functions of the ESCB are divided into 'basic tasks', which are defined in Article 127(2) [of the] TFEU and reproduced in Article 3.1 of the ESCB Statute, and other functions (non-basic tasks) that are scattered throughout other provisions.").

[51] TFEU art. 127(2) (defining the "basic tasks" of the ESCB as crafting and implementing the monetary policy of the EU; conducting foreign-exchange operations; holding and exchanging the official foreign reserves of the Member States; and promoting the smooth operation of payment systems in the EU); ESCB/ECB Statute art. 3.1 (recapitulating the main tasks of the ESCB in language identical to Article 127(2) of the TFEU); *and see* LASTRA, *supra* note 50, at 255 (delineating the conceptual distinction between "basic tasks" and other non-basic tasks).

[52] TFEU art. 128(1) ("The European Central Bank shall have the exclusive right to authorise the issue of euro banknotes within the [EU]."); ESCB/ECB Statute art. 16 ("In accordance with Article 128(1) of the Treaty on the Functioning of the European Union, the Governing Council [of the European Central Bank] shall have the exclusive right to authorise the issue of euro banknotes within the Union.").

[53] TFEU art. 127(5) ("The ESCB shall contribute to the smooth conduct of policies pursued by the competent authorities relating to the prudential supervision of credit institutions and the stability of the financial system.").

[54] *See* TFEU art. 127(4) (stating that the ECB should be consulted "on any proposed [EU] act in [the ECB's] fields of competence" and that national authorities in EU Member States should consult the ECB with respect to "any draft legislative provision in [the ECB's] fields of competence").

collection of statistical information,[55] and international cooperation and external operations.[56] Within the framework outlined above—and for the purposes of this Article—cryptocurrencies can be said to impact both the basic and non-basic tasks of the ESCB."[57]

It seems that the potential effects of cryptocurrencies on central banks can be divided into two broad categories of direct and indirect effects. Cryptocurrencies could directly affect the mandate of the ECB by impinging upon the ECB's ability to control the money supply, or by destroying its monopoly on issuing money.[58] Cryptocurrencies could also indirectly affect the stability of the payment system in the EU, which would fall within the competence of the ECB.[59] Needless to say, the interface between the banking and payment systems is where the potential systemic risk and financial stability concerns lie.[60]

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[55] ESCB/ECB Statute art. 5.1 ("In order to undertake the tasks of the ESCB, the ECB, assisted by the national central banks, shall collect the necessary statistical information either from the competent national authorities or directly from economic agents.").

[56] TFEU art. 219 (providing that the European Council "either on a recommendation from the European Central Bank or on a recommendation from the Commission and after consulting the European Central Bank" may "conclude formal agreements" with countries outside the EU "in an endeavor to reach a consensus consistent with the objective of price stability"); *and see* LASRTA, *supra* note 50, at 267 (describing the ways in which the ESCB takes part in "international cooperation and 'external operations'").

[57] *See* VIRTUAL CURRENCY SCHEMES, *supra* note 28, at 33 (explaining that cryptocurrencies could have an impact to three main tasks of the ECB, namely price stability, financial system stability, and payment system stability), *and* Lastra, *supra* note 50, at 266 (explaining that the ECB is competent to offer and maintain facilities for all manner of payments across the EU).

[58] *See id.* (explaining that cryptocurrencies could have a direct impact on the ECB's main tasks, namely ensuring price stability, ensuring the stability of the financial system, and provide and stable and workable payment system).

[59] *See id.* at 42–43 (2015) (explaining that virtual currency systems seem to operate like retail payment systems, but they are currently "not regulated or closely overseen by any public authority" and so could cause systemic risks for established payment systems as they become more common).

[60] *See id.* at 40 (explaining that virtual currency schemes involve significant credit and liquidity risks because the settlement asset is virtual currency and not fiat currency, and only central banks can help mitigate these risks, "because central banks present no default risk and act as lender of last resort to the member of the system in order to stop any possible chain reaction resulting from payment incidents or unforeseeable liquidity shortages").

Addressing the direct and indirect effects of cryptocurrencies on monetary policy and the payment system should be confined to the limitations imposed on the ECB's functions.[61] In addition to the constraints imposed on its fields of competence, the EU primary and secondary legislation set limitations on the tools that the ECB may use to achieve its objectives.[62] To carry out the tasks of the ESCB, the ECB is granted the powers to adopt legal acts with direct effects on third parties other than the National Central Banks (NCBs) and the Eurosystem by making *regulations* necessary to implement such tasks and taking *decisions.*[63] It can also impose *fines* (through its decisions)

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[61] *See* ESCB/ECB Statute arts. 3, 5 (delineating the power and authority of the ESCB and describing the "basic tasks" to be carried out by the ESCB, as well as certain ancillary tasks, such as the gathering of statistical data).

[62] *See, e.g.*, TFEU art. 127(6) ("The [European Council], acting by means of regulations in accordance with a special legislative procedure, may unanimously, and after consulting the European Parliament and the European Central Bank, confer specific tasks upon the European Central Bank concerning policies relating to the prudential supervision of credit institutions and other financial institutions with the exception of insurance undertakings."); Council Regulation 2015/159 of Jan. 27, 2015, Amending Regulation No. 2532/98 Concerning the Powers of the European Central Bank to Impose Sanctions, 2015 O.J. (L 27) 1, 1–3 (specifying the procedures the ECB must follow when imposing sanctions on an institution that violates ECB regulations, and also specifying an upper bound for the amount of sanctions); Council Regulation 1024/2013 of Oct. 15, 2013, Conferring Specific Tasks on the European Central Bank Concerning Policies Relating to the Prudential Supervision of Credit Institutions, 2013 O.J. (L 287) 63, 63–72 (granting the ECB certain specific powers to oversee credit institutions on an EU-wide level as part of an effort to establish a single banking system in Europe); Council Regulation 2532/98 of Nov. 23, 1998, Concerning the Powers of the European Central Bank to Impose Sanctions, 1998 O.J. (L 318) 4, 4–5 (establishing the basic framework under which the ECB is able to levy sanctions against institutions that violate its regulations).

[63] Consolidated Version of the Treaty on the Functioning of the European Union art. 132(1), July 6, 2016, 2016 O.J. (C 202) 104 (allowing the ECB to "make regulations to the extent necessary to implement the tasks defined" and "take decisions necessary for carrying out the tasks entrusted to the ESCB."). For example, the approval of the volume of coin issuance and sanctions are in the form of decisions. *See id.* at art. 132(3) ("[T]he European Central Bank shall be entitled to impose fines or periodic penalty payments on undertakings for failure to comply with obligations under its regulations and decisions.").

and periodic penalty payments on the undertakings that fail to comply with its regulations and decisions.[64]

In addition to its regulatory powers, the ECB has advisory powers, with which it can adopt non-binding recommendations and opinions within its field of competence.[65]These recommendations can be used to initiate EU legislation or to provide the impetus for action to be taken.[66] With respect to initiating legislation, the ECB has shared competence with the European Commission to initiate the adoption of secondary legislation in order to complement or amend the ESCB/ ECB Statute (i.e., complementary legislation).[67] Furthermore, the ECB

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[64] Consolidated Version of the Treaty on the Functioning of the European Union art. 132(1), July 6, 2016, 2016 O.J. (C 202) 104, art. 132(3) ("[T]he European Central Bank shall be entitled to impose fines or periodic penalty payments on undertakings for failure to comply with obligations under its regulations and decisions."); Council Regulation 1024/2013 of Oct. 15, 2013, Conferring Specific Tasks on the European Central Bank Concerning Policies Relating to the Prudential Supervision of Credit Institutions, 2013 O.J. (L 287) 63, at 20 (EU) (creating the power to impose administrative pecuniary penalties); *See* Council Regulation 2015/159 of Jan. 27, 2015, amending Regulation (EC) 2532/98 Concerning the Powers of the European Central Bank to Impose Sanctions, 2015 O.J. (L 27) 3 (EU) ("inserting Article 1a to explain "[t]his regulation shall apply to the imposition by the ECB of sanctions on undertakings for failure to comply with obligations arising from ECB decisions or regulations."). *See generally* Council Regulation 2532/98 of Nov. 23, 1998, Concerning the Powers of the European Central Bank to Impose Sanctions, 1998 O.J. (L 318) 4 (EC) (defining how the ECB may impose fines and periodic penalty payments on undertakings that fail to comply with the relevant regulations).

[65] TFEU, *supra* note 63, art. 132(1) (empowering the ECB to "make recommendations and deliver opinions").

[66] HANSPETER K. SCHELLER, THE EUROPEAN CENTRAL BANK: HISTORY, ROLE AND FUNCTIONS 70 (European Central Bank, 2d ed. 2006) (explaining the two types of recommendations which include (1) "the instruments by which the ECB may initiate Community legislation," and (2) "the instruments by which the ECB provides the impetus for action to be taken."). The ECB recommendation can be viewed as an instrument by which the ECB encourages action by EU institutions or Member States. *Id.* at 71 ("ECB recommendations, in the traditional sense of the term, may serve as instruments by which the ECB provides the impetus for action (not only of a legal nature) to be taken by Community institutions or Member States.").

[67] TFEU art. 129, *supra* note 63; ESCB/ECB Statute (explaining that the Statute of the ESCB and of the ECB may be amended by the European Parliament and the Council when acting "either on a recommendation from the European Central Bank and after consulting the Commission or on a proposal

should be consulted "on any proposed Union act in its fields of competence" and national authorities should consult the ECB with respect to "any draft legislative provision in its fields of competence."[68] With the creation of the banking union and the Single Supervisory Mechanism (SSM), the ECB has been granted further rule-making powers in the area of financial services regulation.[69] These powers include adopting regulations, guidelines and recommendations, and taking decisions "without prejudice to the competence and the tasks of EBA, ESMA, EIOPA and the ESRB."[70]

Given these regulatory, supervisory, and oversight tools at its disposal, it appears that the ECB may influence the cryptocurrency ecosystem either directly or indirectly.[71] Direct regulation refers to

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from the Commission and after consulting the European Central Bank," *and* that "the Council, either on a proposal from the Commission and after consulting the European Parliament and the ECB or on a recommendation from the ECB and after consulting the European Parliament and the Commission, shall adopt the provisions referred to in Articles 4, 5.4, 19.2, 20, 28.1, 29.2, 30.4 and 34.3 of this Statute."). *See also* SCHELLER, *supra* note 66, at 70 (explaining, as pertaining to complementary or secondary legislation of the ESCB statute, that "[t]he party that does not exercise its right of initiative is to be consulted by the EU Council before the legislation is adopted, i.e. the Commission is consulted when the ECB recommends legislation and vice versa.").

[68] TFEU, *supra* note 30, art. 127(4).

[69] Council Regulation 1024/2013 of Oct. 15, 2013, Conferring Specific Tasks on the European Central Bank Concerning Policies Relating to the Prudential Supervision of Credit Institutions, 2013 O.J. (L 287) 63, arts. 4(3) & 6(5)(a) (providing the first steps toward a banking union by empowering the ECB with the rule-making powers necessary to maintain efficient and consistent functioning of the SSM).

[70] *Id.*, at recitals 7, 31 (explaining that acronyms in quote stand for the European Banking Authority, the European Securities and Markets Authority, the European Insurance and Occupational Pensions Authority, and the European Systemic Risk Board, respectively); *see* Asen Lefterov, *The Single Rulebook: Legal Issues and Relevance in the SSM Context*, at 17 (ECB Legal Working Paper Series, No. 15, Oct. 17, 2015) ("The ECB has been granted the soft powers to adopt guidelines and recommendations, and take decisions subject to and in compliance with the relevant Union law but without replacing the exercise of the EBA tasks." (footnote omitted)).

[71] Lefterov, *supra* note 70, at 17 ("In addition to the [European Advisory Authorities'] soft tools, the Banking Union has granted certain rule-making powers in the field of financial services regulation to the ECB as well as the [Single Resolution Board].")

regulatory measures focusing immediately "on the regulation of the industry itself as a discrete activity"[72] or on the activities immediately performed by business entities, targeting the industry's structure, strategies, and operations, whereas indirect regulation constitutes "market discipline-inspired regulatory measures targeting the creditors and counterparties" of those entities.[73] Direct regulation mainly relies on the threat of the law by using command-and-control regulatory instruments,[74] whereas indirect regulation mainly relies on economic instruments.[75] As its tools, direct regulation "often employs registration, disclosure, capital requirements, and position limits as regulatory instruments."[76] To the contrary, the indirect regulation approach makes use of an intermediary to transmit the commands of regulation to the

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[72] Hossein Nabilou & Alessio M. Pacces, *The Hedge Fund Regulation Dilemma: Direct vs. Indirect Regulation*, 6 WM. & MARY BUS. L. REV. 183, 189 n.25 (2015) (citing PHOEBUS ATHANASSIOU, HEDGE FUND REGULATION IN THE EUROPEAN UNION: CURRENT TRENDS AND FUTURE PROSPECTS 227 (Kluwer L. Int'l, 2009)).

[73] PHOEBUS ATHANASSIOU, HEDGE FUND REGULATION IN THE EUROPEAN UNION: CURRENT TRENDS AND FUTURE PROSPECTS 227 (Kluwer L. Int'l 2009).

[74] *See* JOHN AUSTIN, THE PROVINCE OF JURISPRUDENCE DETERMINED 18–37 (Cambridge Univ. Press 2001) (characterizing command-and-control instruments as the most traditional methods of effecting behavioral change in the subjects of regulation).

[75] ATHANASSIOU, *supra* note 73, at 227 (adding that "[a]n indirect approach could be complemented by the obligatory 'registration' of the managers of hedge funds in conjunction with the (voluntary) improvement … of its transparency, risk management and asset valuation standards and practices." (footnote omitted)); *see also, e.g.*, RICHARD A. POSNER, ECONOMIC ANALYSIS OF LAW 19–23 (Aspen L. & Bus. 1998) (remarking that the roots of the distinction between command-and-control and economic instruments can be found in the literature on legal origins); Rafael La Porta et al., *The Economic Consequences of Legal Origins*, 46 J. ECON. LITERATURE 285, 285–86, 293, 305, 326 (2008) (arguing that countries with civil and common law traditions demonstrate different regulatory styles).

[76] Nabilou & Pacces, *supra* note 72, at 189.

regulated entity or activity.[77] This regulatory approach is often more efficient if there are suitable "surrogate regulators."[78]

Despite the potential direct impact of the cryptocurrencies on central banking and given the limited scope for direct intervention by the ECB, the Article will focus mainly on indirect intervention through the ECB's supervisory powers over the banking entities[79] as well as the ECB's regulatory and oversight powers over payment systems.[80] However, even within the indirect approach, given the hybrid nature of cryptocurrencies and the constraints on the ECB's scope of competence and regulatory powers, the ECB, as a regulator, supervisor or overseer, may not act alone in addressing the challenges of cryptocurrencies.[81] In certain areas, the ECB can act as a catalyst for change, within its advisory capacity, or act in tandem with other regulators (such as the European Commission and the European Parliament, the EBA, and the National Competent Authorities (NCAs) including NCBs), or act in accordance with its contributory competence in protecting financial stability in cooperation with the NCAs.[82] Further-

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[77] ATHANASSIOU, *supra* note 73, at 227–28, 234 ("The aim of [indirect regulation] would be to enhance the counterparty risk management practices that financial institutions apply in their dealings with hedge funds and/or to impose disclosure duties on prime brokers and other crucial hedge fund ounterparties in respect of their hedge fund exposures.").

[78] Nabilou & Pacces, *supra* note 72, at 205 (arguing that surrogate regulators may make indirect regulation more appropriate in some situations thanks to the competition amongst surrogate regulators to maximize efficiency).

[79] For example, as the ECB is bound to collateralize its credit operations under article 18.1, second indent of the ESCB/ECB Statute, the ECB can refuse any cryptocurrency collateral or any asset that is linked to cryptocurrencies as collateral under its collateral regime.

[80] *See* Protocol No. 4 on the Statute of the European System of Central Banks and of the European Central Bank art. 18, Dec. 1, 2009 ("In order to achieve the objectives of the ESCB and to carry out its tasks, the ECB and the national central banks may … conduct credit operations with credit institutions and other market participants, with lending being based on adequate collateral.") For example, such a regulatory approach would be conducted through setting out participation and access criteria for payment and banking institutions involved in cryptocurrency business for the access to the TARGET2.

[81] VIRTUAL CURRENCY SCHEMES, *supra* note 28, at 42–45, (explaining that because "Virtual currency schemes visibly lack a proper legal framework," it becomes difficult for central banks to address the regulation problems by themselves).

[82] *See* KAREL LANNOO, CTR. FOR EUR. POLICY STUDIES, ECB BANKING SUPERVISION AND BEYOND, 33, 48 (2014), https://papers.ssrn.com/sol3/

more, at the international level, the ECB can contribute to the policy formulation within the international financial fora, in particular, within the Financial Stability Board (FSB).[83]

II. Cryptocurrencies, Monetary Policy, and Price Stability

At least two catalysts can act as an impetus for the ECB's direct involvement in the cryptocurrency markets due to their direct impact on the *instruments* exclusively issued by the ECB (i.e., banknotes). The first catalyst would be the functional similarities between cryptocurrencies and the base money issued by central banks, and the second would be the potential for wider adoption of cryptocurrencies that would have a negative impact on the basic tasks of the ECB (i.e., by having an impact on the transmission of monetary policy, ultimately affecting price stability).[84]

Lex Monetae is the body of laws and regulations that defines the monetary law of a state or a currency union.[85] In the euro area, in addition to the TFEU and the ESCB/ECB Statute, the *Lex Monetae* of the Eurozone participating Member States is embedded in Council Regulation 974/98[86] and Council Regulation (EC) 1103/97.[87] The former regulation "defines monetary law provisions of the Member States

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papers.cfm?abstract_id=2561205 [https://perma.cc/K5PW-BCSS] (discussing the roles of the ECB and NCAs within their supervisory roles).

[83] *See id.* at 12 ("[T]he ECB and Financial Stability Board (FSB), have stepped-in to monitor and supervise the activities of cross-border banking groups in the EU and internationally.").

[84] *See* EUR. CENT. BANK, *Crypto-Assets: Implications for financial stability, monetary policy, and payments and market infrastructures* 21-22 (2019), https://www.ecb.europa.eu/pub/pdf/scpops/ecb.op223~3ce14e986c.en.pdf [https://perma.cc/CD8L-ABFN] (discussing that while currently, cryptocurrency is neither the functional equivalent of money nor does it pose systematic stability issues impacting the ECB, that in principle, or in the future, cryptocurrency could achieve these objectives).

[85] *See* Eva Micheler, *The Changeover to the Euro and Russian Law*, 24 REV. CENT. & EAST EUR. L. 245, 246 (1998) ("*Lex monetae* determines whether a thing is money and what nominal value is to be attributed to it.").

[86] Council Regulation (EC) 974/98 of May 3, 1998, on the introduction of the euro, 1998 O.J. (L 139) 1, 1–5 (codifying the *lex monetae* policy of Eurozone participants in the creation of the euro).

[87] Council Regulation (EC) 1103/97 of June 17, 1997, on certain provisions relating to the introduction of the euro, 1997 O.J. (L 162) 1, 1–3 (codifying the principle of *lex monetae* for the creation of the euro).

which have adopted the euro."[88] Article 2 of this regulation sets the euro as the currency of the participating Member States.[89] Within this framework, the ECB has "the exclusive right to authorise the issue of euro banknotes within the Union."[90] Although the Member States can issue *euro coins*, the volume of said issuance is subject to the approval by the ECB.[91] The banknotes and coins issued by the ECB and National Central Banks (NCBs) have the *legal tender* status within the Union.[92]

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[88] Council Regulation (EC) 974/98 of May 3, 1998, on the introduction of the euro, 1998 O.J. (L 139) 1, 1 ("[D]efines monetary law provisions of the Member States which have adopted the euro. ...").

[89] Council Regulation (EC) 974/98 of May 3, 1998, on the introduction of the euro, 1998 O.J. (L 139) 1, 3 ("As from 1 January 1999 the currency of the participating Member States shall be the euro.").

[90] Consolidated Version of the Treaty on the Functioning of the European Union art. 128, Sept. 5, 2008, 2008 O.J. (C115) 103 ("The European Central Bank shall have the exclusive right to authorise the issue of euro banknotes within the Union."); Protocol No. 4 on the Statute of the European System of Central Banks and of the European Central Bank art. 16, Dec. 1, 2009 ("In accordance with Article 128(1) of the Treaty on the Functioning of the European Union, the Governing Council shall have the exclusive right to authorise the issue of euro banknotes within the Union.").

[91] Consolidated Version of the Treaty on the Functioning of the European Union art. 128, Sept. 5, 2008, 2008 O.J. (C115) 103 ("Member States may issue euro coins subject to approval by the European Central Bank of the volume of the issue."); Protocol No. 4 on the Statute of the European System of Central Banks and of the European Central Bank art. 16, Dec. 1, 2009 ("In accordance with Article 128(1) of the Treaty on the Functioning of the European Union, the Governing Council shall have the exclusive right to authorise the issue of euro banknotes within the Union.").

[92] *See* TFEU Art. 128(1); ESCB/ECB Statute Art. 16 (stating that "legal tender" status is assigned to banknotes and coins in the Union); *see also* Council Regulation (EC) No 974/98 of 3, May 1998 on the introduction of the euro, OJ L 139, 11.5.1998, 1–5 (stating "these coins shall be the only coins which have the status of legal tender"). As the delegation of monetary sovereignty is "complete, unconditional, and irrevocable," the only source of monetary law in the eurozone participating Member States is the EU law. *See generally* CHARLES PROCTOR, MANN ON THE LEGAL ASPECT OF MONEY (7th ed. 2012) ; Helmut Siekmann, *Exit, Exclusion, and Parallel Currencies in the Euro Area* 13 (Inst. for Monetary & Fin. Stability, Working Paper No. 99, 2015).

Granting full control over the base money enables the Eurosystem to formulate and implement monetary policy.[93] This is perhaps why, when the Managing Director at Estonian e-Residency laid out its proposal for issuing crypto tokens—called 'estcoins'—to its e-residents through an ICO,[94] ECB's Mario Draghi adamantly opposed it stating that "no member state can introduce its own currency. … The currency of the euro zone is the euro."[95] Developments of this kind, along with the keen interest of central banks in studying and, as regards some, exploring the possibility of issuing their own digital currencies,[96] have shown the importance of the preservation of the unit of

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[93] SCHELLER, *supra* note 66, at 48 ("The Eurosystem's capacity to formulate and implement the monetary policy of the euro area is ensured by its full controll over base money.").

[94] *See* Kaspar Korjus, *Estonia Could Offer 'estcoins' to E-residents*, MEDIUM (Aug. 22 2017), https://medium.com/e-residency-blog/estonia-could-offer-estcoins-to-e-residents-a3a5a5d3c894 [https://perma.cc/94HC-574C] (discussing the proposal of the introduction of estcoins); *see also* Lionel Laurent, *The Bitcoin Sovereign Wealth Fund; Estonia Wants in on the Crypto-Currency Bubble*, BLOOMBERG (Aug. 25, 2017, 2:00 AM), https://www.bloomberg.com/opinion/articles/2017-08-25/forget-oil-future-sovereign-wealth-funds-run-on-bitcoin (stating an Estonian agency has proposed "raising money by selling 'estcoins' to the public").

[95] Francesco Canepa, *ECB's Draghi Rejects Estonia's Virtual Currency Idea*, REUTERS (Sept. 7, 2017, 12:34 PM), https://www.reuters.com/article/us-ecb-bitcoin-estonia/ecbs-draghi-rejects-estonias-virtual-currency-idea-idUSKCN1BI2BI [https://perma.cc/N8V4-D58S]. Although such a position by the president of the ECB could be criticized on the ground that non-euro denominated cryptocurrencies, which are not intended to serve as legal tender, despite being issued by state actors, would not be in contravention to the EU primary or secondary laws. For details about the legal issues of Non-euro denominated CBDC, *see* PHOEBUS L. ATHANASSIOU, DIGITAL INNOVATION IN FINANCIAL SERVICES: LEGAL CHALLENGES AND REGULATORY POLICY ISSUES 204–206 (2018) [hereinafter DIGITAL INNOVATIONS IN FINANCIAL SERVICES].

[96] *See generally* Bech & Garratt, *supra* note 31, at 55 (stating that "many interested parties are wondering whther central banks should issue their own versions" of cryptocurrencies). Other central banks, such as Sweden's Riksbank, are considering issuing digital currencies (e-krona in the case of Riksbank), though at the time of writing, there is no final decision as to the issue or technical specification of e-krona. To follow this project, *see* Sveriges Riksbank, *The Riksbank's e-krona project, Report 1* (Sept. 2017) ; *see also* SVERIGES RIKSBANK, THE RIKSBANK'S E-KRONA PROJECT, REPORT 2 (Oct. 2018) [hereinafter RIKSBANK REPORT 2]. For the pros and cons of central bank digital currencies, *see generally* Max Raskin & David Yermack, *Digital*

account as a coordination device across many products and services for the society at large.

In this sense, issuing any cryptocurrencies or parallel units of account—in particular by a *state actor*—offering functionalities similar to central bank money (CeBM) or base money could be in contradiction to Article 128(1) of the TFEU, Article 16 of the ESCB/ECB Statute, as well as Article 11 of the Regulation 974/98, and would be deemed illegal.[97] In what follows, highlighting the functional similarities between cryptocurrencies and CeBM we argue that such similarities would eventually trigger the involvement of central banks in cryptocurrencies. Although issuing banknotes and coins is not specified as a basic task, given the ECB's exclusive right to issue base money,[98] and the close relationship between this right and price stability, we start with exploring the relationship and similarities between cryptocurrencies and CeBM, and the potential impact of cryptocurrencies on the monopoly of central banks over issuing base money, and then turn to the impact of cryptocurrencies on monetary policy and price stability.

A. Cryptocurrencies' Similarities to Base Money

Despite the fact that issuing base money (note issue) has been considered as the *raison d'être* of central banking,[99] it is not included in the basic tasks of the ECB. In addition, the ECB's "exclusive right to authorise the issue of euro banknotes within the Union"[100] does not mean that issuing *money* is the sole prerogative of central banks. Indeed, commercial banks have been in the business of money creation

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Currencies, Decentralized Ledgers, and the Future of Central Banking (Nat'l Bureau of Econ. Res., Working Paper No. 22238, 2016).

[97] *See* TFEU Art. 128(1); ESCB/ECB Statute Art. 16; *see also* Council Regulation, art. 11, Council Regulation (EC) No 974/98 of 3, May 1998 on the introduction of the euro, OJ L 139, 11.5.1998, 1–5.

[98] *See* sources cited TFEU Art. 128(1); ESCB/ECB Statute Art. 16 (granting the ECB sole authority to issue base money).

[99] *See* Lastra, *supra* note 50, at 34 (discussing the vitality of note issue to central banking); *see also* CHARLES GOODHART, THE EVOLUTION OF CENTRAL BANKS 105 (MIT Press 3d prtg. 1991) (stating that "[t]he development of Central Banks [concentrated] on note issue").

[100] *See* TFEU, *supra* note 34, art. 128(1); ESCB/ECB Statute, *supra* note 48, art. 16 ("the Governing Council shall have the exclusive right to authorize the issue of banknotes within the Community").

since long before the advent of modern central banking.[101] Despite the legal tender designation of CeBM, which consists of banknotes and

[101] Unlike many suggestions to the contrary, issuing money has not been the sole prerogative of governments. History has witnessed instances of successful and sustainable private money competing with the sovereign money and even threatening its dominance. *See, e.g.*, GEORGE A SELGIN, GOOD MONEY: BIRMINGHAM BUTTON MAKERS, THE ROYAL MINT, AND THE BEGINNINGS OF MODERN COINAGE, 1775–1821 12–13, 240–41 (2011). For further discussion of private coinage creation and how it became outlawed, in particular recounting Mr. Monck's gold coins, *see also* Charles A. E. Goodhart, *The Two Concepts of Money: Implications for the Analysis of Optimal Currency Areas*, 14 EUR. J. POLITICAL ECON. 407, 418 (1998) (describing historical analyses of monetary evolution, including one view that money developed in part because the private sector sought to minimize the transaction costs of trading.). ESWAR S. PRASAD, GAINING CURRENCY: THE RISE OF THE RENMINBI 7 (2017) ("Although paper money had been used during the Song dynasty, Kublai can be credited with two major (and closely related) innovations: fiat money and legal tender."); CHARLES P. KINDLEBERGER & ROBERT Z. ALIBER, MANIAS, PANICS, AND CRASHES: A HISTORY OF FINANCIAL CRISES 75 n.21 (2005) (describing how prior to fiat money, the history of paper money goes back to more than 2,000 years ago in China, where the bills of exchange (used as money) were known as 'flying money'); DAVID WOLMAN, THE END OF MONEY: COUNTERFEITERS, PREACHERS, TECHIES, DREAMERS—AND THE COMING CASHLESS SOCIETY 1 (2012) ("Paper money was born in China, perhaps as far back as AD 800.").

There have also been periods during which private bank notes coexisted alongside the government-issued banknotes. *See, e.g.*, Warren E. Weber, *Government and Private E-money-like Systems: Federal Reserve Notes and National Bank Notes*, (Bank of Canada, Working Paper No. 2015-18, 2015) ("The period from 1914 to 1935 is unique in that it was the only time that both privately-issued and governmentally-issued bank notes were simultaneously in circulation."); Lawrence H. White, *Competing Money Supplies*, THE LIBRARY OF ECONOMICS AND LIBERTY (2018), https://www.econlib.org/library/Enc/CompetingMoneySupplies.html?to_print=true ("Much more competition in money has existed in the past. Under "free banking" systems, private banks routinely issued their own paper currencies, or "banknotes," that were redeemable for underlying "real," or "basic," monies like gold or silver.").

Only in contemporary history has the state had the monopoly over issuing banknotes (legal tender). Ajit V. Pai, *Congress and the Constitution: The Legal Tender Act of 1862*, 77 OR. L. REV. 535, 537 (1998) (presenting a brief history of currency in the United States.). For example, the first Legal Tender Act in the U.S. was passed in February 1862 authorizing the issuance of notes (greenbacks) which were "lawful money and legal tender in payment

coins,[102] evidence from the UK suggests that banks create and allocate approximately 97% of the money supply.[103] However, there are significant differences between commercial bank money (CoBM) and cryptocurrencies that would warrant a different approach by central banks towards cryptocurrencies.[104]

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of all debts, public and private within the United States." *Id.* (quoting the Legal Tender Act). This act was part of the government efforts to finance the civil war. *Id.* (describing Congress' passage of the Act when "[f]aced with the acute need to finance the Civil War"). It seems that until 1862, the issuance of banknotes was mainly a private enterprise in the US, a historical episode sometimes dubbed "free banking era." Peter Conti-Brown, *Central Banking and Institutional Change in the United States: Punctuated Equilibrium in the Development of Money, Finance, and Banking, in* RESEARCH HANDBOOK ON CENTRAL BANKING 4 (Peter Conti-Brown and Rosa M. Lastra, eds., 2018) ("After the collapse of the Second Bank of the United States, the US saw a rise of what has been called "free banking.").

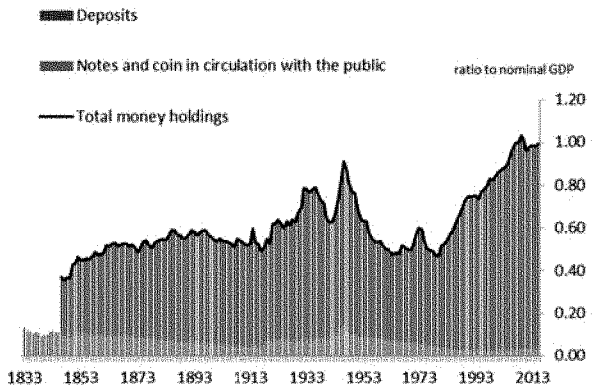
An alternative to standard monopoly on the issuance of notes by the central bank is minimal competition (central bank-issued notes with commercial bank-issued notes backed by the central bank notes on a one to one basis, as occurs in Scotland and Northern Ireland, where bank-issued notes are allowed, but backed by the Bank of England notes, currency boards and real competition (free banking)). *See* Forrest Capie & Geoffrey Wood, *The Development of the Bank of England's Objectives: Evolution, Instruction or Reaction?, in* RESEARCH HANDBOOK ON CENTRAL BANKING 33–34 (Peter Conti-Brown and Rosa M. Lastra, eds., 2018) (describing the instability from bank-issued currency and the bailouts that had to come from the Bank of England).

[102] Thomas J. Jordan, Chairman of the Governing Bd., Swiss Nat'l Bank, How Money Is Created by the Central Bank and the Banking System (Jan. 16, 2018) ("Central bank money, like all nominally denominated money, is subject to the risk of inflation."). It should be noted that Demand deposits held by commercial banks at the central bank are also part of the CeBM. However, only banknotes and coins are legal tender, but not the demand deposits held by commercial banks at the central bank.

[103] Richard A. Werner, *How Do Banks Create Money, and Why Can Other Firms Not Do the Same? An Explanation for the Coexistence of Lending and Deposit-Taking*, 38 INT'L R. FIN. ANALYSIS 71, 72 (2014).

[104] *See* Hossein Nabilou, *Testing the Waters of the Rubicon: The European Central Bank and Central Bank Digital Currencies*, J. BANKING REG. (2019).

Chart 1 Most money held in bank accounts, not as physical cash



Sources: Hills, Thomas and Dimsdale (2015)[9] and Bank of England

Unlike bitcoin, both CoBM (or bank-issued IOUs representing claims against a commercial bank in CeBM) and shadow banking quasi-money (securities or promises to pay CeBM or CoBM during a certain period of time in the future)[105] are claims against the issuer. This difference in nature entails that cryptocurrencies are also different in terms of the risks associated with them. Even if central banks pursue a price stability objective, CeBM is prone to inflation risk.[106] However, bitcoin effectively carries no inflation risk as it has a capped and fixed supply schedule.[107] Similar to CeBM, Bitcoin carries no default risk as

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[105] Perry Mehrling, *The Inherent Hierarchy of Money*, *in* SOCIAL FAIRNESS AND ECONOMICS: ECONOMIC ESSAYS IN THE SPIRIT OF DUNCAN FOLEY 396 (Rezai L. Taylor & T. Michl eds., 2012); Zoltan Pozsar, *Shadow Banking: The Money View* (Office of Fin. Research, Working Paper No. 14-04, 2014) ("Money claims are also hierarchical (see Mehrling, 2012), in the sense that not all money claims are equally strong in their par on demand promise in all states of the world, and that always and everywhere money is something different for central banks, banks, shadow banks and all other participants in the financial ecosystem.").

[106] Jordan, *supra* note 102 ("Central bank money, like all nominally denominated money, is subject to the risk of inflation.").

[107] This cap can also be changed in the protocol if there is sufficient consensus. It seems that such a consensus would be very hard to come by. See *Frequently Asked Questions*, BITCOIN.ORG, https://bitcoin.org/en/faq#general ("Bitcoin is unique in that only 21 million bitcoins will ever be created.").

on-chain Bitcoin transactions are conducted on a near real-time gross settlement basis on the Bitcoin blockchain.[108] However, the elimination of inflation risk comes at the cost of price volatility, given that Bitcoin's fixed supply schedule is unable to effectively respond to demand shocks for Bitcoin.[109] Therefore, unlike CeBM or CoBM, Bitcoin exposes users to the risks associated with price volatility.

CoBM is decentralized in its creation in the sense that it is demand-driven (i.e., demand for credit) and is created by commercial banks as they make loans (i.e., endogenous money).[110] In other words, the distinctive feature of CoBM is that it is a relatively decentralized credit creation and allocation mechanism, which is elastic and respon-

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[108] Although there is no counterparty default risk in Bitcoin transactions, using Bitcoin exposes the users to operational or technical risks stemming from the settlement finality risks. As will be explained in Section 4 of this paper, transactions in Bitcoin are often batched by the miners and appended to the latest blockchain which, on average, takes ten minutes. During this time and the time that is required for the transaction to be deemed final (customarily six confirmations taking approximately sixty minutes), the users are exposed to the technical or operational risks. Therefore, Bitcoin transactions are not real-time. They cannot be viewed as the equivalent of Deferred Net Settlement (DNS) Systems as they do not offer the advantages of that system in terms of economizing on liquidity and do not have counterparty default risks between the execution and settlement endemic to the DNS systems. For the lack of a better term, we use near real-time settlement. *See* Nabilou, *infra* 871–77.

[109] *Id.* ("In addition to the fixed supply schedule of certain cryptocurrencies, as the cryptocurrency exchanges offer bidirectional flows between fiat money and cryptocurrencies, market participants have an easy way out to fiat money, which could give rise to the extreme volatility of the settlement asset in cryptocurrency payment systems in times of illiquidity").

[110] *See* GIANCARLO BERTOCCO, ENDOGENOUS MONEY (Louis-Philippe Rochon & Sergio Rossi eds., Edward Elgar Publishing 2015); Claudio Borio, *The Financial Cycle and Macroeconomics: What Have We Learnt?*, 45 J. BANKING & FIN. (2014).; Richard A. Werner, *How Do Banks Create Money, and Why Can Other Firms Not Do the Same? An Explanation For the Coexistence of Lending and Deposit-taking*, 36 INT'L REV. FIN. ANALYSIS (2014).; Richard A. Werner, *Can Banks Individually Create Money Out of Nothing—The Theories and the Empirical Evidence*, 36 INT'L REV. FIN. ANALYSIS (2014) [hereinafter *Can Banks Individually Create Money Out of Nothing?*].; Richard A. Werner, *A Lost Century in Economics: Three Theories of Banking and the Conclusive Evidence*, 46 INT'L REV. FIN. ANALYSIS (2016). (citing authority that supports the contention that CoBM is decentralized).

sive to the demand shocks.[111] However, in addition to inflation risks, CoBM carries default risks.[112] Although money creation in the commercial banking sector remains discretionary, the ability of a commercial bank in creating money is limited by the central bank's monetary policy, the commercial bank's risk-return calculations (including considerations of current and future interest rates, the likelihood of defaults on loans or deposit withdrawals), and capital and liquidity requirements.[113]

CoBM is issued by commercial banks, which in major jurisdictions are licensed or supervised by central banks, and—where available—enjoy the protection of a deposit insurance fund. In addition, on a daily basis, CeBM is used as the ultimate settlement asset in wholesale payment systems, which means that the value and convertibility of CoBM is being put to the test on a daily basis.[114] In other words, despite its designation as privately issued money, in effect, CoBM is an extension of CeBM.[115] However, this daily final settlement in CeBM, which ensures the convertibility of CoBM to CeBM, does not in principle apply to cryptocurrencies as most of them do not aim to maintain a par value with fiat currencies.[116] In other words, the value of CoBM is pegged to CeBM and it is a claim against the commercial bank to pay CeBM.[117] It is exactly in this sense that cryptocurrencies are essentially different from CoBM despite both being private money.

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[111] This would mean that it is unlikely that cryptocurrencies would eliminate the need for CoBM. *See Can Banks Individually Create Money Out of Nothing*?, *supra* note 111.

[112] *See* Borio, *supra* note 111 (stating another risk of CoBM).

[113] Jordan, *supra* note 102 ("In their calculations, banks take into consideration actors such as current and future interests on loans and deposits, the likelihood of despoit withdrawals and credit defaults, and the liquidity and capital adequacy requirements in force").

[114] EUROPEAN CENTRAL BANK, THE PAYMENT SYSTEM: PAYMENTS, SECURITIES AND DERIVATIVES, AND THE ROLE OF THE EUROSYSTEM 45 (2010). [hereinafter THE PAYMENT SYSTEM] ("And the use of central bank money in payment systems puts the value of the commercial banks' liabilitites to the test every day by checking their convertibility into the defined unit of value.").

[115] *Id.* ("An essential feature of a national payment system is the fact that it involves the circulation of two types of money which are of uniform value.").

[116] *See id.* (distinguishing cryptocurrency from both CoBM and CeBM by pointing out that cryptocurrency is not tied to another currency).

[117] *Id.* ("Preserving the uniform value of the currency is a key task entrusted to the central bank. It is important that a currency have a uniform value, as

Since cryptocurrencies are used as the ultimate settlement asset within their own blockchains, they bear a resemblance to CeBM as the ultimate settlement asset both for retail and wholesale payments. As the ECB has a monopoly on the issuance of the ultimate settlement asset,[118] potential wider adoption of cryptocurrencies by the general public and their use as the settlement asset within their own blockchains covering everyday transactions would be in direct contradiction with that role of CeBM. In other words, the daily convertibility of CoBM to CeBM entails that CoBM does not attempt to become a unit of account and a separate parallel currency that directly compete with CeBM, but cryptocurrencies do.

To conclude, Bitcoin and many other cryptocurrencies are not credit or shadow banking quasi-money; they share with CeBM the key feature that they do not represent a claim.[119] At least in theory, mass adoption of cryptocurrencies could challenge the monetary sovereignty of a nation-state (i.e., the monetary policy flexibility and independence and central banks' control over money supply) and governments' seigniorage revenues coming from creating money. Needless to say, the realization of such potential threats, however unlikely they may be, would justify the central banks' intervention.

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otherwise a currency cannot perform its 'unit of account' function in an effective manner.").

[118] Although CoBM can also be used as an ultimate settlement asset (especially in some cross-border payments and settlements systems), most international standards as well as national regulations require the use of CeBM in the wholesale payments and settlement systems. *See* Regulation of the European Central Bank (EU) No 795/2014, art. 10 of 3 July 2014 on oversight requirements for systemically important payment systems (ECB/2014/28) 2014 O.J. (L 217), 16–30,

[119] Raskin & Yermack, *supra* note 96. Similar to CeBM, Bitcoin is not a claim or promise to pay and despite its accounting treatment, central banks do not view CeBM as a liability. *See What is Money?*, EUROPEAN CENTRAL BANK (2015), https://www.ecb.europa.eu/explainers/tell-me-more/html/what_is_money.en.html. [https://perma.cc/N2GY-T6TL] ("There are even newer decentralized digital currencies or virtual currency schemes like Bitcoin that exist without a central point of control like a central bank. These are not regarded as money from a legal perspective"). However, it seems that even in its current form CeBM could be thought of as a 'liability' or a promise. *See* Nick Rowe, *From Gold Standard to CPI Standard* (Apr. 5, 2012), https://worthwhile.typepad.com/worthwhile_canadian_initi/2012/04/from-gold-standard-to-cpi-standard.html; Nick Rowe, *Is Money a Liability?* (Mar. 12, 2012), https://worthwhile.typepad.com/worthwhile_canadian_initi/2012/03/is-modern-central-bank-money-a-liability.html.

B. Impact on Price Stability

Unit of account is the signature property of money.[120] Stability of the unit of account is crucial for a currency to become and remain a unit for the uniform measurement of value across several goods and services.[121] Therefore, it is no surprise that ensuring price stability through inflation targeting has become one of the primary objectives of central banking.[122]

Central banks often view competition in the provision of currencies as somewhat healthy for the economy, in that multiple issuers of money can help enhance innovation and efficiency in the provision of payment and other financial services.[123] For example, in the ECB's view, neither mono-banking (central banks having the monopoly over the issuance of money) nor free banking (commercial banks as the sole suppliers of money) would be sufficiently stable or efficient, and coexistence of CeBM and CoBM should be preserved.[124] However, as mentioned earlier, there is a fundamental difference between privately issued bank liabilities, like money, and cryptocurrencies.[125] If, similar to cryptocurrencies, bank liabilities had different values independently

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[120] CHRISTINE DESAN, MAKING MONEY: COIN, CURRENCY, AND THE COMING OF CAPITALISM 1 (2014) ("In economic terminology, [money] is a unit of account, a mode of payment, and a medium of exchange, more interesting for what it does than for what it is.").

[121] THE PAYMENT SYSTEM, *supra* note 115, at 45 ("It is important that a currency have a uniform value, as otherwise a currency cannot perform its "unit of account" function in an effective manner.").

[122] *Id.* ("Preserving the uniform value of the currency is a key task entrusted to the central bank.") Although central banks either have a single mandate (such as the ECB—which is price stability), or dual mandate (such as the US Federal Reserve—which is price stability and employment), price stability has always been one of their basic tasks. Recently, there are suggestions to move from inflation targeting to (N)GDP targeting.

[123] THE PAYMENT SYSTEM, *supra* note 115, at 45 ("Having multiple issuers of money preserves the advantages of competition in the provision of innovative and efficient payment services—and, indeed, in the provision of financial services in general.")

[124] *Id.* ("The two extreme alternative arrangements of mono-banking (where the central bank acts as the sole issuer of money) and free banking (where commercial banks provide all the money required by the economy) have not proven to be sufficiently stable or efficient.").

[125] Berentsen & Schär, *supra*, note 21, at 98–99 (discussing differing characteristics of commercial bank money and cryptocurrency).

of the CeBM and accordingly the prices would have been quoted in terms of those liabilities, every good or service would have had different quoted prices,[126] making it virtually impossible for the central bank to pursue its price stability objective.[127] If a central bank cannot guarantee the uniform value of the unit of account, it would mean that multiple currencies would be used in a single currency area.[128] This, in turn, would create obstacles to trade in a single market.[129] This scenario would be highly likely if various cryptocurrencies—especially those issued by various state actors—were widely accepted.[130]

In addition to being detrimental to the integrity of the unit of account, cryptocurrencies can have an impact on price stability by their potential impact on the demand for CeBM and an impact on the control of money through the open market operations of central banks.[131] As for the former, based on the quantity theory of money (QTM),[132]

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[126] THE PAYMENT SYSTEM, *supra* note 115, at 45 ("If banks' liabilities had different values, different prices would have to be set for every good or service for each of the bank monies used—i.e. depending on whether a consumer paid with the liabilities of one bank or another.").

[127] *Id.* ("Confidence in central bank money depends on the ability of the central bank to maintain the value of the stock of the currency as a whole – i.e. to maintain price stability.").

[128] *Id.* ("If the uniform value of the currency was not guaranteed, there would, in effect, be multiple currencies within what is meant to be a single currency area, thereby creating a major obstacle to trade in what is meant to be a single market.").

[129] *Id.* ("If the uniform value of the currency was not guaranteed, there would, in effect, be multiple currencies within what is meant to be a single currency area, thereby creating a major obstacle to trade in what is meant to be a single market.").

[130] It is noteworthy to mention that the wider adoption and circulation of cryptocurrencies as a means of payment may not be in contradiction to legal tender laws), despite its potential damage to the integrity of the unit of account. *See e.g.*, Council Regulation 974/98, art. 10, 11, 1998 O.J. (L 139) 4, 5 (EC) (setting forth the European Union's currency-issuing requirements and authority).

[131] VIRTUAL CURRENCY SCHEMES, *supra* note 28, at 33–34 ("[V]irtual currency schemes could have an impact on price stability and monetary policy if they affect the demand for the central bank's liabilities and interfere in the control of the supply of money through open market operations."); VIRTUAL CURRENCY SCHEMES—A FURTHER ANALYSIS, *supra* note 24, at 23–25 ("In theory, VCS could have an impact on monetary policy and price stability.").

[132] *See* VIRTUAL CURRENCY SCHEMES, *supra* note 28, at 36 (observing that according to the quantity theory of money (QTM), the following equation

the impact of cryptocurrencies on price stability highly depends on their impact on the quantity and the velocity of money.[133] First, if widely accepted, cryptocurrencies can affect price stability by increasing the quantity of *money* in circulation.[134] Second, wider acceptance of cryptocurrencies would decrease the velocity of fiat money, because the increased use of cryptocurrencies would eat into the share of the fiat money in real-world and virtual transactions.[135] In addition, general acceptance of cryptocurrencies can cause distortions to the information content of monetary aggregates.[136] At its extreme, if public acceptance of cryptocurrencies would reach levels such that the CeBM would no longer define the unit of account, similar to the historical cases of dollarization, central bank monetary policy could become obsolete.[137]

Thus far, there is no empirical evidence on the impact of cryptocurrencies on price stability.[138] However, the price stability objective of central banks would be under threat by the proliferation

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relates the aggregate prices (P) and total money supply (M): P = MV/Y, where V is velocity of money and Y is real output).

[133] *Id.* at 34 ("The velocity of money is a measure of how often a unit of currency is spent to purchase goods and services produced in the economy.").

[134] *See id.* (listing the three main ways virtual currency schemes could affect price stability, the first one being "substantially modify the quantity of money").

[135] *See id.* (highlighting that velocity of money depends "on the number of active virtual currency scheme users" therefore, because the number of transactions would not be measurable in a centralized way, the velocity of money would also be unknown for the central bankers).

[136] *Id.* at 35 (explaining that an increase in use of virtual money may decrease the use of fiat money, the "substitution effect" which would "make it more difficult to measure monetary aggregates"). This concern has also been raised in the context of e-money.

[137] Dong He, *Monetary Policy in the Digital Age*, 55 FIN. & DEV. 13, 15 (2018) [hereinafter *Monetary Policy in the Digital Age*] ("[I]f central bank money no longer defines the unit of account … then the bank's monetary policy becomes irrelevant."); *see* VIRTUAL CURRENCY SCHEMES, *supra* note 28, at 35 ("[W]hen virtual money is created outside the realm of the central bank … the central bank's control over money and credit developments could become less effective.").

[138] *See generally* VIRTUAL CURRENCY SCHEMES, *supra* note 28, at 33–35 ("[T]his chapter is not intended to be a fully-fledged analysis; rather it is a first attempt at providing a basis for discussion on this issue."); *id.* at 26 (summarizing and reaffirming ECB's initial report in 2012 that its price stability analysis is "in theory").

and wider acceptance of cryptocurrencies through their impact on the demand for money and on the mechanism for the transmission of monetary policy.[139] This would keep central banks on their toes, as it would pose both reputational risks to central banks and would jeopardize the mechanism at their disposal for carrying out their basic tasks.[140]

C. Impact on Monetary Policy

In addition to the impact on the demand for CeBM, cryptocurrencies can affect monetary policy indirectly by removing certain policy options necessary for its implementation.[141] In this respect, the potential impact of cryptocurrencies can be explained in light of the trilemma of international finance.[142] Such an effect can materialize by providing new venues for the users of the currency to circumvent capital controls.[143] The trilemma of international finance suggests that for every country, it is only possible to have two of the following policy options at any point in time: unrestricted international capital markets, a managed exchange rate, and an independent monetary policy.[144] Wider or even global adoption of cryptocurrencies would

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[139] *See id.* at 35 (using the example of Q-coin in China showing how Q-coin had such significant effects and widespread use that the Chinese government ultimately banned it due to "its possible impact on the real financial system").

[140] *Id.* at 45 (advising that reputational risk "should be considered when assessing the overall risk situations of central banks" because an increase in virtual currency schemes would "attract [negative] press coverage" if the public perceives the "central banks not doing their jobs properly").

[141] *See also* Pieters, *supra* note 27, at 20 (using bitcoin to show that a virtual currency makes the international finance trilemma into a dilemma only).

[142] *See* FREDERIC S. MISHKIN, THE ECONOMICS OF MONEY, BANKING, AND FINANCIAL MARKETS 508–09 (Pearson, 11th ed. 2016) (describing the "policy trilemma" as a country being able to follow only two of the following principles at the same time: "(1) free capital mobility, (2) a fixed exchange rate, and (3) an independent monetary policy").

[143] Pieters, *supra* note 27 at 24–25 (explaining that bitcoin allows capital control circumvention in countries like Argentina and hypothesizing there would be "unrestricted international capital markets" should bitcoin be allowed to "become big enough").

[144] *Id.* at 23–24 ("The trilemma states that any country can have only two of the following: (1) unrestricted international capital markets, (2) a managed exchange rate or (3) an independent monetary policy.").

render international capital markets unrestricted by default.[145] Therefore, there remain two options for policymakers and central banks from which only one should be chosen: managed exchange rates or independent monetary policy. In this scenario, if a country wants to manage its exchange rate, its monetary policy will automatically become reactive and cease to be independent.[146]

As mentioned throughout the Article, the impact of cryptocurrencies on central banks is largely dependent on the widespread adoption of such currencies by the general public.[147] However, despite Bitcoin's unique attributes and the fact that the wider adoption of parallel cryptocurrencies would make it difficult for central banks to achieve their price stability objective, the prospect of the CeBM being replaced by bitcoin is virtually nil.[148] This is mainly due to certain

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[145] *Id.* at 20–25 ("Thus, with bitcoin, (1) unrestricted international capital markets is chosen by default.").

[146] Otherwise, if a country chooses unrestricted international capital markets, and independent monetary policy, it should invariably adopt a floating exchange rate because it will be bereft of tools to manage its exchange rate. *See* N. Gregory Mankiw, *The Trilemma of International Finance*, N.Y. TIMES (July 10, 2010), https://www.nytimes.com/2010/07/11/business/economy/11view.html [https://perma.cc/P3SY-QGEX] (explaining that economic policy can choose only two of three goals: open international capital flows, independent monetary policy, and stable currency exchange rates).

[147] *See supra* Parts 1, 2.2.

[148] A virtually hard cap and inflexible supply schedule on the number of bitcoins begets price volatility in response to the demand shocks, making it a hard sell as a unit of account. The hard cap on the number of bitcoins additionally means that the adoption of bitcoin by any country would put hard limits on the monetary policy and effectively remove monetary sovereignty, making bitcoin unattractive for any country to use it as a currency. Therefore, in its current form, price stability under bitcoin standard would be highly unlikely. In terms of monetary policy, bitcoin is dissimilar to CoBM, which is demand driven and very much responsive to the demands for credit. The same applies to the quasi-money created by the shadow banking system. *See* Lucinda Shen, *Cryptocurrencies Like Bitcoin Can't Replace the Dollar, Says New York Fed Chief Nominee*, FORTUNE (Apr. 20, 2018, 8:00 PM), https://fortune.com/2018/04/20/bitcoin-new-york-fed-central-bank-jack-dorsey/ [https://perma.cc/8V4D-4Q5T] (explaining reasons why cryptocurrencies cannot replace paper money); Vivien Lee & David Wessel, *Digital Currencies: Five Big Implications for Central Banks*, BROOKINGS: UP FRONT (May 21, 2018), https://www.brookings.edu/blog/up-front/2018/05/21/digital-currencies-five-big-implications-for-central-banks/ [https://perma.cc/2W6V-

limitations that are embedded in the Bitcoin protocol by design. Due to the limitation on supply, unlike CeBM, Bitcoin does not have inflation risk.[149] However, it has compromised three important functions of a stable monetary system. First, within a monetary system based on Bitcoin, there would be no protection against the risk of structural deflation.[150] Second, the inflexible supply schedule would deprive policymakers of significant policy levers and remove the possibility of any flexible response to temporary shocks to Bitcoin demands and the possibility of smoothing the business cycle and minimizing macroeconomic dislocations, which is considered one of the main functions of monetary policy.[151] And third, such limitations would effectively remove the possibility of having a lender of last resort (LOLR).[152] As a consequence, in its current form, price stability under the Bitcoin standard would be hard to achieve.[153] This discourages Bitcoin adoption at the nation-state or the currency-area level.[154] The above-

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G89L] (discussing the implications of replacing physical currency with digital currencies).

[149] Although each cryptocurrency (bitcoin) has a limit on its total number, there is no limit on the cryptocurrency brands that could be issued. Currently, there are more than 2,000 different cryptocurrencies and proliferation of such currencies are likely to lead to suboptimal or unstable equilibria and affect price stability. *See* Daniel R. Sanches, *Bitcoin vs. the Buck: Is Currency Competition a Good Thing?*, 3(Q2) ECON. INSIGHTS, FED. RESERVE BANK OF PHILA. 9, 13 (2018) ("In the absence of substantial barriers to entry, as is now the case, the number of cryptocurrency brands is not fixed.").

[150] *See Money from Nothing*, THE ECONOMIST (Mar. 15, 2014), https://www.economist.com/finance-and-economics/2014/03/15/money-from-nothing [https://perma.cc/H373-9JB2] (explaining how Bitcoin can suffer from deflation); *Bitcoin's Deflation Problem*, THE ECONOMIST (Apr. 3, 2014), https://www.economist.com/free-exchange/2014/04/03/bitcoins-deflation-problem" https://www.economist.com/free-exchange/2014/04/03/bitcoins-deflation-problem [https://perma.cc/ZY8R-N7CS] (explaining that deflation will prevent Bitcoin from becoming a unit of account).

[151] *See* Milton Friedman, *The Role of Monetary Policy*, 58 AM. ECON. REV. 1, 12–14 (1968) (describing the various ways money can produce economic stability).

[152] *Monetary Policy in the Digital Age*, *supra* note 138, at 13–14 (2018) (identifying that stable monetary regimes must have the capacity to function as a lender of last resort).

[153] *See id.* at 16 ("[Central banks] can remain relevant by providing more stable units of account than crypto assets . . ...").

[154] George Selgin, *Synthetic Commodity Money*, 17 J. FIN. STABILITY 92, 98 (2015) ("I am inclined to argue that, while it is possible to conceive of a

mentioned limitations put specific constraints on Bitcoin's promise of becoming a unit of account that aims to replace CeBM.[155] This being said, a scenario where a cryptocurrency would become a parallel or concurrent currency is not totally inconceivable.[156] In that case, the question would be whether it is acceptable for central banks—as part of their mandate to oversee the payment system and the wider FMIs—to welcome the existence of parallel currencies (and payment systems) outside the current formal banking and payment systems and with a settlement asset on which the central bank has no control.[157] Although the coexistence of centralized and decentralized payment systems would ensure an additional layer of redundancy and would increase the resilience of the overall payment system,[158] it may forgo the benefits of

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government-sponsored synthetic commodity monetary regime, it is difficult to imagine a government actually embracing the idea, and more difficult still to imagine one that would not be tempted to interfere with, and ultimately to undermine, an established synthetic commodity standard by means of its ability to introduce and to confer legal tender status upon some new fiat currency.").

[155] It is also unlikely that bitcoin becomes a substitute for CoBM, as the latter has its unique advantages serving various needs of a given economy. This analysis is only applicable to bitcoin because of its specific properties in terms of capped supply schedule, but it may not be applicable to other cryptocurrencies. However, most other cryptocurrencies (including algorithmic stablecoin projects) face limitations that put a question mark on economic fundamentals and their adoption prospects. *See* Fabian Schär & Aleksander Berentsen, *Stablecoins: The Quest for a Low-Volatility Cryptocurrency*, *in* THE ECONOMICS OF FINTECH AND DIGITAL CURRENCIES 65, 67 (Antonio Fatás ed. 2019) ("Of all the stability mechanisms that we discuss in this chapter, algortihmic stablecoins are the least convincing, and we strongly recommend against using them.").

[156] Raskin & Yermack, *supra* note 96, at 2 ("Algorithmic digital currencies such as bitcoin appear to be viable competitors to central bank fiat currency, and their presence in the marketplace may pressure central banks to pursue tighter monetary policy"). However, as the development of banking and shadow banking around bitcoin cannot be ruled out, bitcoin may in the future directly compete against commercial bank, as well as shadow banking money. *Id.* at 1 ("Digital currencies were created to compete with central banks").

[157] *See id.* at 15 ("As a disruptive new technology, digital currency forces governments and central banks to choose between banning, tolerating, or co-opting its innovations.").

[158] Prasad, *supra* note 32, at 14 (explaining that the "proliferation of payment systems could increase financial stability by creating multiple levels of redundancies," so that the failure of one will not harm the system as a whole).

economies of scale in using a single payment system and it would pose threats to the credibility of the unit of account if those alternative cryptocurrencies are widely accepted.[159] The hypothesis where CeBM is sidelined by cryptocurrencies would also pose a reputational risk to central banks as it could be detrimental to the concept of the unit of account,[160] and may eventually result in the loss of central banks' control over money supply.[161]

Although many studies contemplate that cryptocurrencies can affect monetary policy,[162] due to the relatively small size of the markets, thus far there has been no evidence of such an impact.[163] However, there have been suggestions that a correlation exists between bitcoin price premia and global capital flows/flights.[164] Although a

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[159] *See* Raskin & Yermack, *supra* note 96, at 14 (explaining that economies of scale are achievable as "[c]entral banks process transactions on behalf of businesses, consumers, banks, and international counterparts, and even small gains in efficiency can save vast amounts of money").

[160] *See* VIRTUAL CURRENCY SCHEMES, *supra* note 28, at 33 (acknowledging that the retention of a unit account is one of the most important challenges posed by cryptocurrencies to the traditional payment system).

[161] Mohamed Damak, *The Future of Banking: Cryptocurrencies Will Need Some Rules to Change the Game*, S&P GLOBAL (Feb. 19, 2018), https://www.spglobal.com/en/research-insights/articles/the-future-of-banking-cryptocurrencies-will-need-some-rules-to-change-the-game [https://perma.cc/6YRD-N4ZL] ("If cryptocurrencies were to take off and become an effective currency issued in a decentralized manner, the impact on monetary policy implementation would be deep, since central banks might lose their ability to control money supply.").

[162] Robleh Ali et al., *The Economics of Digital Currencies*, Q3 BANK OF ENG. Q. BULL., Sept. 16, 2014, at 276 (studying the risks and effects of intergrating digital currencies to the Bank of England's monetary policies); DIGITAL CURRENCIES, *supra* note 17, at 16 ("If the adoption and use of digital currencies were to increase significantly, the demand for existing monetary aggregates and the conduct of monetary policy could be affected, although at present, the use of private digital currencies appears too low for these risks to materialise.").

[163] *See* DIGITAL CURRENCIES, *supra* note 17, at 16 (explaining that if use of the digital currencies is large, "monetary policy may lose efficacy").

[164] *See* Bloomberg, *What Bitcoin Signals About Global Capital Flows*, BLOOMBERG TV (Sept. 29, 2017), https://www.bloomberg.com/news/videos/2017-09-29/what-bitcoin-signals-about-global-capital-flows-video [perma.cc/44GV-GRXN] (describing how capital flights out of China were correlated with an increase in bitcoin premia). Among the ESCB's basic tasks are conducting foreign-exchange operations, holding and managing the official for-

correlation should not be mistaken for causation, it can serve as an early warning sign on which further focus would be warranted.[165] Concerns about the disruption in the implementation of monetary policy due to the wider adoption of cryptocurrencies would warrant central banks' vigilance in closely watching the developments in this space.[166]

Thus far, we have discussed the *direct* effects of cryptocurrencies on central banking that would warrant their *direct* involvement in the cryptocurrency ecosystem.[167] There are further second-order or *indirect* effects that could trigger central banks' *indirect* involvement in cryptocurrency markets, but before discussing those challenges, it is important to discuss the policy options and tools at the ECB's disposal to determine if the ECB can directly intervene in cryptocurrency markets.[168]

III. ECB's Policy Options

Although the intuitive knee-jerk reaction to the potential direct impact of cryptocurrencies on monetary policy and price stability would entail direct regulation of cryptocurrencies (e.g., banning such

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eign reserves of the Member States. *See* EUR. CENT. BANK, *Tasks*, https://www.ecb.europa.eu/ecb/tasks/html/index.en.html [https://perma.cc/5UKU-ZR32]. Under this mandate, the ECB may be given the power to hold and intervene in cryptocurrencies. *See* Billy Bambrough, *New ECB Boss Christine Lagarde Made a Serious Bitcoin Warning*, FORBES (July 7, 2019, 06:17 AM), https://www.forbes.com/sites/billybambrough/2019/07/07/new-ecb-boss-christine-lagarde-made-a-serious-bitcoin-warning/#686c89e22ed9 [https://perma.cc/49LQ-MZD7] (explaining that the new head of the European Central Bank, Christine Lagarde, is "extremely pro digital assets"). Such powers would be necessary for the successful implementation of monetary policy under the unlikely scenario of cryptocurrencies making international capital markets unrestricted, *see id.* (explaining that the bitcoin and cryptocurrency community strongly welcomed Lagarde as president of ECB due to her "crypto friendly" outlook).

[165] *See* Bloomberg, *supra* note 165 (suggesting that the correlation can be used to track global capital but should not be used to monitor bitcoin conclusively).

[166] *See* DIGITAL CURRENCIES, *supra* note 17, at 17 (listing a number of topics that central banks will need to monitor, such as impacts on the payments system, privacy of transactions, and impacts on financial stability).

[167] *See supra* Sections 1, 2.

[168] *See infra* Section 3.2.

currencies),[169] this Article argues that such a response would be neither feasible nor desirable. Instead, indirect regulation of cryptocurrencies through banking and payment systems would hold the promise of achieving the regulatory objectives without jeopardizing the potential benefits of fintech innovation.[170] Based on the mandate and competences of the ECB, as well as the regulatory and supervisory tools at its disposal, it seems that many of the mechanisms for ECB intervention in the cryptocurrency ecosystem are among the mechanisms that only allow for the ECB's *indirect* intervention.[171] Within this indirect regulation, central banks can have a prominent role to play, particularly by their regulatory and oversight powers on the credit institutions and payment systems and their role as a contributor to financial stability-enhancing policies.[172]

Direct and indirect regulatory measures can be either in the form of technical measures (i.e., non-regulatory measures) or regulatory measures.[173] A manifestation of *direct regulatory measures* by the ECB would be rejecting cryptocurrencies and digital assets as collateral (i.e., eligible marketable assets) within its collateral eligibility

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[169] *See* DIGITAL CURRENCIES, *supra* note 17, at 12 ("Prohibition: authorities could seek to ban the use of digital currencies in their respective jurisdictions … this could imply a ban on any digital currency-based financial activities, as well as digital currency exchanges or digital currency acceptance by retailers.").

[170] *Id.* (proposing regulation of specific entities as an option, as opposed to outright prohibition).

[171] ECB Crypto-Assets Task Force, *Crypto-Assets: Implications for Financial Stability, Monetary Policy, and Payments and Market Infrastructures*, (Eur. Cent. Bank Occasional Paper Series No 223, 2019), https://www.ecb.europa.eu/pub/pdf/scpops/ecb.op223~3ce14e986c.en.pdf [hereinafter ECB Crypto-Assets Task Force] ("Given the current state of law, there is limited scope for public authorities to intervene; moreover, regulatory intervention would be further complicated by the lack of governance and distributed architecture of crypto-assets.").

[172] *See* DIGITAL CURRENICES, *supra* note 17, at 3 ("[S]hould digital currencies and distributed ledgers become widely used … their impact on other areas of responsibility for central banks, such as payment system oversight and regulation, financial stability and monetary policy, might become more prominent.").

[173] *See generally* Barbara Stettner, Hilary Sunghee Seo & Jonathan Flynn, *USA*, in FINTECH 2019 at 274, 274–285 (Global Legal Insights 1 ed. 2019) (describing the mix of regulations and restrictions that apply to the evolving field of "Fintech").

framework in the ECB operations.[174] Furthermore, as a *direct technical measure*, the regulator may consider regulating the code itself and imposing design-based requirements on the code or protocol.[175] However, as far as the ECB is concerned, it would fall outside the scope of its mandate and competence.[176] *Indirect regulatory measures* would be achieved largely by the regulatory and supervisory measures targeting banks and payment institutions, for example, imposing stricter criteria for access to the FMIs and technical platforms operated by the ECB on the banking and payment institutions providing payment services in cryptocurrencies.[177] Finally, *indirect technical measures* would focus either on improving the efficiency and addressing the shortcomings of the existing payment and settlement systems, thereby indirectly influencing cryptocurrencies, or they would be aimed at venturing into the unchartered territory of issuing CBDCs, to which we will return in the final part of the Article.[178]

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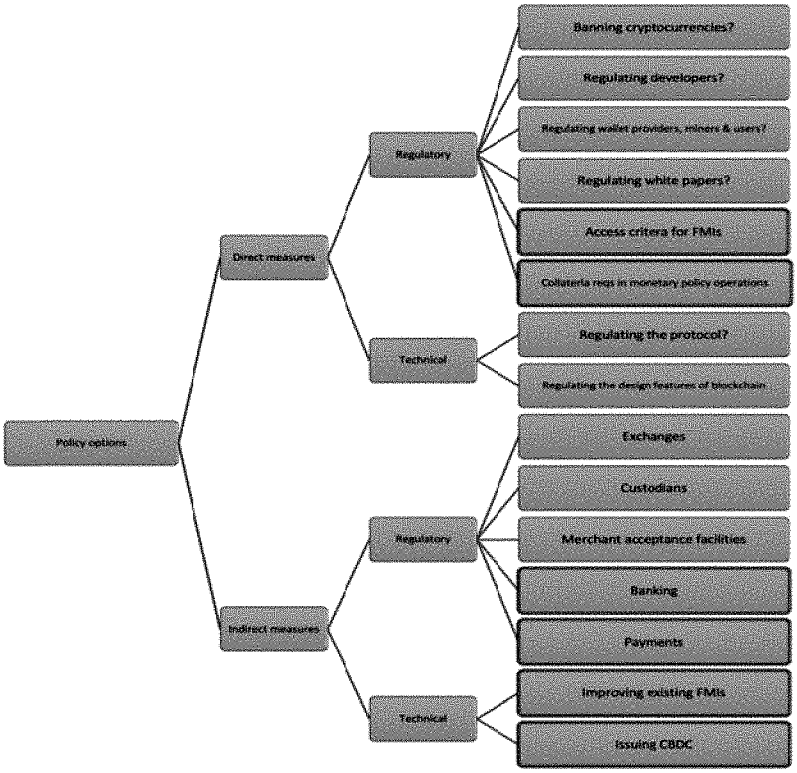
[174] MIP OnLine, *Crypto-assets - Trends and Implications*, EUR. CENT. BANK (June 2009), https://www.ecb.europa.eu/paym/intro/mip-online/2019/html/1906_crypto_assets.en.html [https://perma.cc/3BZJ-P6WG] ("Furthermore, CCPs are not permitted to use crypto-assets as collateral because they are not on the list of eligible collateral under the Commission Delegated Regulation (EU) 2016/2251.").

[175] Primavera De Filippi & Samer Hassan, *Blockchain Technology as a Regulatory Technology: From Code is Law to Law Is Code*, FIRST MON. (Dec. 5, 2016), https://firstmonday.org/ojs/index.php/fm/article/view/7113/5657 ("The third phase [in the evolving relationship between law and technology] involves the incorporation of legal rules into code on the one hand, and the emergence of regulation by code on the other").

[176] ECB Crypto-asset Task Force, *supra* note 172, at 28 ("Under EU law as it stands, crypto-assets as defined in this report do not appear to fit under any of the subject matter-relevant EU legal act.").

[177] *Id.* at 29 ("[T]here could be avenues for the regulation, at EU level, of crypto-assets business at the intersection with the regulated financial system, i.e. aimed at crypto-asset "gatekeeping" services, namely crypto-assets custody and trading/exchange services.").

[178] ANNUAL ECONOMIC REPORT, BANK FOR INT'L SETTLEMENTS, at 108 (June 2018), https://www.bis.org/publ/arpdf/ar2018e.pdf (explaining that authorities can implement a regulatory approach by conducting a "redrawing of regulatory boundaries").



Policy options for addressing the risks of cryptocurrencies.

A. Direct Regulation of Cryptocurrencies

Based on the concerns about the unit of account, price stability, and the impact on the conduct of monetary policy, central banks might take an interest in regulating cryptocurrencies directly.[179] Direct regulation of cryptocurrencies can take many forms.[180] It could involve

[179] *Monetary Policy in the Digital Age*, *supra* note 138, at 16 (suggesting that central banks may "remain relevant by providing more stable units of account than crypto assets and by making central bank money attractive as a medium of exchange in the digital economy").

[180] *See* PRIMAVERA DE FILIPPI & AARON WRIGHT, BLOCKCHAIN AND THE LAW: THE RULE OF CODE 175 (Harv. Univ. Press. 2018) ("The most direct way governments can regulate the use of blockchain technology is by imposing laws and regulations directly on end users.").

regulating the code or protocol (i.e., design-based regulation),[181] developers,[182] the design features of a given blockchain, node operators, wallet providers,[183] miners, and users, or imposing rules and standards for governing white papers.[184] On the contrary, regulation of exchanges, where cryptocurrencies are exchanged for fiat money, custodians (including custodian wallet providers) and other service providers, such as merchant acceptance facilities, would belong to the realm of indirect regulation.[185]

An example of direct regulatory intervention may include imposing a blanket ban on cryptocurrencies and sanctioning the individuals, exchanges, financial institutions, and payment processors from

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[181] For the concept of design-based regulation and examples thereof, *see* LAWRENCE LESSIG, CODE: AND OTHER LAWS OF CYBERSPACE (Basic Books 1999); LAWRENCE LESSIG, CODE: VERSION 2.0 (Basic Books 2006); DE FILIPPI & WRIGHT, *supra* note 182; Lawrence Lessig, *The New Chicago School*, 27 J. LEGAL STUD. 661, 690 (1998) (describing design-based regulation).

[182] Angela Walch, *In Code(rs) We Trust: Software Developers as Fiduciaries in Public Blockchains*, *in* REGULATING BLOCKCHAIN: TECHNO-SOCIAL AND LEGAL CHALLENGES (Philipp Hacker et al. eds., Oxford Univ. Press forthcoming 2019) (arguing public developers of blockchain act as fiduciaries). For a dissenting view, *see A Primer on Bitcoin Governance*, *supra* note 18 (arguing bitcoin miners and users govern protocol); *see also* Jerry Brito & Peter van Valkenburgh, *Writing and Publishing Code Alone Cannot Be a Crime*, COINCENTER.ORG (Oct. 29, 2018) (arguing smart contract code is purpose-agnostic and developers should not be held responsible for crimes in which the code is used).

[183] Such wallet providers could be regulated as Money Service Businesses (MSBs) requiring money transmitter license, or money remittance service providers, both of which are equivalent to payment institutions in the EU. *See* Carl A. Fornaris et al., *Alert: FinCEN Issues Guidance on Application of Regulations to Certain Business Models Involving Convertible Virtual Currencies*, GREENBERG TRAURIG (June 2019), https://www.gtlaw.com/en/insights/2019/6/fincen-issues-guidance-on-application-of-fincens-regulations-to-certain-business-models [https://perma.cc/G3XK-67KV] (describing requirements and regulations for wallet providers as MSBs).

[184] DE FILIPPI & WRIGHT, *supra* note 182, at 179, 181, 187 (providing differing ways to regulate code indirectly).

[185] *Id.* at 186 ("While a government does not have the ability to engage in traditional monetary policies with a blockchain …, it can nonetheless intervene on an open market by either buying or selling a blockchain's native digital currency in an attempt to ultimately increase or decrease its price.").

handling or dealing in cryptocurrencies.[186] On the other extreme of the spectrum, the ECB may be given the power to hold cryptocurrencies as part of its tasks under conducting foreign-exchange operations or holding and managing the official foreign reserves of the Member States.[187] As the ECB and NCBs can "acquire and sell spot and forward all types of foreign exchange assets and precious metals," and as "foreign exchange assets" include "securities and all other assets in the currency of any country or units of account and in whatever form held," it would be difficult to argue that the ECB would not have the power to acquire and hold cryptocurrencies if need be.[188]

As certain forms of direct regulation of cryptocurrencies would rely on design-based regulation, this approach cannot be independent of the specific features of the cryptocurrency in question and its underlying blockchain.[189] For example, cryptocurrencies based on an open, or public, (unrestricted) blockchain are to be treated differently from those built on a closed, or private, (restricted) blockchain with identifiable and relatively centralized nodes.[190] In the same vein, largely centralized cryptocurrency schemes, such as Ripple, should be treated differently from decentralized ones such as bitcoin.[191] The dependence of direct regulatory approach on the design features of the specific cryptocurrency poses a serious challenge to direct regulation

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[186] Global Legal Research Directorate Staff of the Library of Congress, *Regulation of Crypto currency in Selected Jurisdictions*, 1, 30 (June 2018) (stating China's government does not recognize cryptocurrency).

[187] EUR. CENT. BANK, STATUTE OF THE ESCB AND OF THE ECB, 17, (2011) https://www.ecb.europa.eu/pub/pdf/other/ecbinstitutionalprovisions2011en.pdf [https://perma.cc/GL6S-N7A4] (hereinafter STATUTE OF THE ESCB AND OF THE ECB] (allowing the ECB to acquire, sell spot, and forward all types of foreign exchange assets).

[188] *Id.* (describing ECB's external operations). If bitcoin becomes a major currency in the future, central banks may engage in buying and intervening in the bitcoin markets under the mandate of managing their foreign reserves. As this scenario appears to be unlikely at the moment, this paper will not discuss it.

[189] DE FILIPPI & WRIGHT, *supra* note 182, at 171 (discussing direct and indirect regulation of cryptocurrencies).

[190] *See* Praveen Jayachandran, *The Difference between Public and Private Blockchain*, BLOCKCHAIN PULSE: IBM BLOCKCHAIN BLOG (May 31, 2017), https://www.ibm.com/blogs/blockchain/2017/05/the-difference-between-public-and-private-blockchain/ [https://perma.cc/QW6V-QFSU] (describing the difference between public and private blockchain).

[191] Prasad, *supra* note 32, at 10–13 (providing comparisons by country for regulatory schemes).

approach as recent proliferation of cryptoassets with various features would make direct regulation of cryptocurrencies an arduous task.[192]

For tokens issued on permissioned distributed ledgers, direct regulation would be straightforward as it can target the proprietors of the ledger or the nodes with access to the ledger and the authority to validate it.[193] Therefore, for centralized cryptocurrencies, mandatory creation of a scheme governance authority (body), information technology (IT) security requirements, requirements on transaction verification process (e.g., the number of nodes and miners and confirmations needed for the finality of transactions on the blockchain) can be imposed by the law to be built into the design of a given cryptocurrency.[194] Operational and business continuity requirements, disclosure of the identity of node operators, requirements such as investor or user vetting process or customer due diligence before making the wallet or coin available to the user can be imposed directly on these identifiable scheme authorities.[195] Although imposing most of the aforementioned requirements would go far beyond the existing scope of competence of the ECB, the ECB can have a role in its advisory capacity.[196]

Despite the fact that many cryptocurrencies are designed to be decentralized and censorship-resistant, those features do not necessarily mean that direct regulation of cryptocurrencies is destined to fail or be ineffective.[197] Although governments can hardly do away with decentralized cryptocurrencies, they can disrupt their growth.[198] As with all currencies, the success of any currency depends on its widespread adoption. However, a government ban on cryptocurrencies can severely undermine their network effects.[199] In addition, an aggressive

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[192] *See* Michel Rauchs et al., *Second Gloal Cryptoasset Benchmarking Study* (Dec. 2018) https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3306125 (discussing the proliferation of cryptoasset).

[193] Zetzsche, *supra* note 13, at 1370–74 (explaining the use of tokens in permissioned distributed ledgers).

[194] *See generally* Bordo & Levin, *supra* note 2 (discussing the role of a central bank of digital currency to regulate cryptocurrency).

[195] *Id.* at 6 (explaining methods for verifying account holders and operators).

[196] STATUTE OF THE ESCB AND OF THE ECB, *supra* note 189, at 7 (describing the objectives and tasks of the ECB).

[197] *Id.* (describing the objectives and tasks of the ECB).

[198] *See* Rauchs, *supra* note 194, at 26 (stating the growth of the industry headcount is up 164%).

[199] William J. Luther, *Cryptocurrencies, Network Effects, and Switching Costs*, 34 CONTEMPORARY ECON. POLICY 553, 554, 570 (2016) (arguing that governments are capable of undermining bitcoin due to their ability in stifling

tax policy, such as designating bitcoin as property for tax purposes and imposing property taxes each time a bitcoin or a fraction of it changes hands, as is the case in some jurisdictions, would severely stifle its adoption as a medium of exchange.[200]

B. Challenges to Direct Regulation and Opportunities for Indirect Regulation of Cryptocurrencies

There are several reasons supporting the position that direct regulation of cryptocurrencies by central banks may not be desirable, or even possible, and may eventually fail to achieve the intended goals.

First, decentralized cryptocurrencies are borderless and direct regulation would encourage regulatory arbitrage.[201] This is due to two main issues. First, no government can effectively ban a sufficiently decentralized cryptocurrency such as Bitcoin.[202] Due to the P2P nature of Bitcoin, banning or aggressively regulating it will presumably only push it to the darker corners of the virtual world.[203] Second, if only a few jurisdictions allow Bitcoin, such a ban would become ineffective because of regulatory arbitrage.[204] The relatively decentralized nature

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network effects and that in the absence of major breakthroughs, it is unlikely that bitcoin would gain widespread adoption). On the other side of the spectrum, some believe that profit seeking incentives of entrepreneurs can contribute to the widespread adoption of bitcoin. *See* Malavika Nair & Nicolás Cachanosky, *Bitcoin and Entrepreneurship: Breaking the Network Effect*, 30 REV. AUSTRIAN ECONS. 263, 271 (2017) (explaining that entrepreneurial firms lower switching costs while in pursuit of maximizing economic gain for themselves).

[200] *See* Bal, *supra* note 15, at 277–281 (discussing various tax schemes); Hossein Nabilou, *How to Regulate Bitcoin? Decentralized Regulation for a Decentralized Cryptocurrency*, 27 INT'L J. L. & INFO. TECH. 266, 275 (2019).

[201] Nabilou, *supra* note 202; Pieters, *supra* note 27, at 22 ("Bitcoin is globally traded, yet there is no global regulatory framework for it."); *Virtual Currencies and Beyond*, *supra* note 12, at 18 (2017) ("At present, there is little consistency in regulatory approaches across jurisdictions. This may undermine regulation at the national level and create incentives for regulatory arbitrage.").

[202] *See* Nabilou, *supra* note 202; Pieters, *supra* note 27, at 22 (suggesting attempts to ban cryptocurrency outright have not been entirely successful).

[203] Nabilou, *supra* note 202; *see generally* BILTON, *supra* note 2 (detailing the dark corners of the illegal drug trade and cryptocurrency's role).

[204] *See* Nabilou, *supra* note 202; *Virtual Currencies and Beyond*, *supra* note 12, at 18 (pointing to the risk of regulatory arbitrage).

of cryptocurrencies, their digital nature, their global reach, and the young and nimble industries that are being evolved within this ecosystem create border problems[205] and a wide scope for regulatory arbitrage across borders.[206] In the cryptocurrency sphere, if a cryptocurrency is legally allowed only in one jurisdiction, it is likely that it would spread across borders in the virtual world.[207] This has already been the case in the regulator's cat and mouse game in the area of illegal download websites and decentralized protocols for P2P file sharing such as BitTorrent.[208] In the context of cryptocurrencies, after the New York BitLicense, there have been reports of businesses, including exchanges, that changed their domicile with unprecedented pace.[209] In 2017, a year in which the Bank of China took actions to regulate and ban ICOs, cryptocurrency markets witnessed a shift in the global trading volume from Chinese Yuan (CNY) to Japanese Yen (JPY) and the US dollar (USD).[210]

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[205] Charles A. E. Goodhart & Rosa M. Lastra, *Border Problems*, 13 J. INT'L ECON. L. 705, 714–16 (2010) (discussing the border problems resulting from uncoordinated regulatory regimes); Charles Goodhart, *The Boundary Problem in Financial Regulation*, 206 NAT. INST. ECON. REV. 48 (2008) (discussing challenges in policing border problems); Nabilou, *supra* note 202, at 280.

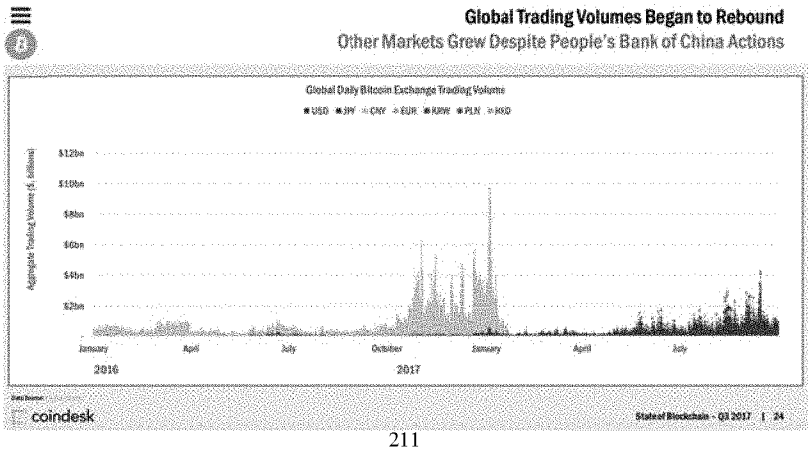
[206] For the concept of regulatory arbitrage, *see* Hossein Nabilou, *Regulatory Arbitrage and Hedge Fund Regulation: The Need for a Transnational Response*, 22 FORD. J. CORP. & FIN. L. 557, 562–65 (2017) (defining and discussing regulatory arbitrage generally); *see also* Nabilou, *supra* note 202, at 280.

[207] *See* Nabilou, *supra* note 202, at 280; Pieters, *supra* note 27, at 22 (calling attention to the ease with which trading cryptocurrency can bypass regulatory hurdles).

[208] Primavera De Filippi & Samer Hassan, *Blockchain Technology As a Regulatory Technology: From Code Is Law to Law Is Code*, 21 FIRST MONDAY 1, 4 (2016) (describing how the decentralized peer-to-peer structure of BitTorrent frustrates enforcement); Nabilou, *supra* note 202, at 280.

[209] For example, the two exchanges that shifted their businesses offshore or to other states were Kraken and Shapeshift. *See* Daniel Roberts, *Behind the "Exodus" of Bitcoin Startups from New York*, FORTUNE (Aug. 14, 2015) https://fortune.com/2015/08/14/bitcoin-startups-leave-new-york-bitlicense/ ("The new defectors are all following ShapeShift, a startup led by outspoken bitcoin entrepreneur Erik Voorhees, which was the first to go, cutting off service to New York just days after the BitLicense came out."); *see also* Nabilou, *supra* note 202, at 280.

[210] Nabilou, *supra* note 202, at 280; Noelle Acheson, *China's ICO Ban*, COINDESK (Sept. 12, 2017, 11:03 UTC) https://www.coindesk.com/chinas-



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Second, the one-size-fits-all measures typical of direct regulation cannot adequately address the wide variety and heterogeneity of cryptocurrencies and the strategies of the businesses evolving around them.[212] There is a plethora of actors playing distinct roles in the cryptocurrency sphere.[213] They include developers, issuers, miners, processing service providers, users, wallet providers, exchanges, and other trading platforms such as decentralized exchanges (DEX),[214] merchant acceptance facilities, and various other actors.[215] To say the least, due to various design features of emerging cryptocurrencies, a one-size-fits-all regulatory solution could at best be counterproductive.[216]

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ico-ban-understandable-reasonable-probably-temporary [https://perma.cc/2U4T-8EL7] (discussing China's ICO ban).

[211] *State of Blockchain Q3 2017*, COINDESK at Slide 24 (Nov. 27, 2017) https://media.coindesk.com/uploads/research/state-of-blockchain/2017/q3/sob2017q3.pdf [https://perma.cc/7YYC-MF9U].

[212] *See* Nabilou & Pacces, *supra* note 72, at 204–05 (discussing the inability of a one-size-fits-all regulatory approach to the heterogenous hedge fund industry).

[213] A FURTHER ANALYSIS, *supra* note 28, at 7–8 ("The 'ecosystem' of virtual currency schemes consists mainly of specific, new categories of actors which were not present in the payments environment before. This list provides a description of the most relevant ones.").

[214] For more details on DEX, *see* Lindsay X. Lin, *Deconstructing Decentralized Exchanges*, 2 STAN. J. BLOCKCHAIN L. & POLICY 58, 59–60 (2019) (describing the architecture of decentralized exchanges).

[215] For a detailed description, *see* A FURTHER ANALYSIS, *supra* note 28, at 7–8.

[216] *See* Nabilou & Pacces, *supra* note 72, at 204–05.

The main problem with direct regulation of cryptocurrencies is that decentralized permissionless blockchain-based cryptocurrencies—designed to resist censorship—are antithetical to the existing structure of financial regulation.[217] These cryptocurrencies can exist and function independently of the existing institutions and market infrastructures, and they may not fit into any existing legal framework.[218] The issue becomes even more complicated as some issuing organizations have neither managers nor a real or corporate entity or place of domicile.[219] Therefore, the direct regulation of cryptocurrencies, to the extent possible, would run into the practical question of what or whom to regulate. In the absence of a centralized governance scheme, it is hard to propose a direct regulatory approach to regulating cryptocurrencies.[220]

The closest that regulations can get to regulating such cryptocurrencies is regulating miners, and perhaps relatively centralized nodes on the Lightning Network[221] if that network proves its long-term viability. Indeed, as the second-layer solutions are developed, it is reasonable to expect business communities to develop around them which could be directly identifiable and targeted by regulators. How-

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[217] Hossein Nabilou, *How to Regulate Bitcoin? Decentralized Regulation for a Decentralized Cryptocurrency*, 27 INT'L J. L. & INFO. TECH. 266, 278 (2019) ("The main problem with regulating cryptocurrencies is that decentralized permissionless blockchain-based cryptocurrencies are antithetical to the existing structure of financial regulation.").

[218] *Id.* at 278–79 ("Cryptocurrencies can also exist and function independently of the existing institutions and market infrastructures that make taming them even more difficult.").

[219] *Virtual Currencies and Beyond*, *supra* note 12, at 9 (describing the fragmented and potentially anonymous issuance of virtual currencies).

[220] Yves Mersch, Member, Exec. Bd. of the Eur. Cent. Bank, Speech at the 39th Meeting of the Governor's Club of The Central Asia, Black Sea Region and Balkan Countries: Virtual Currencies Ante Portas (May 14, 2018) ("VCs cannot be directly regulated or overseen in the absence of a centralised governance and legal framework.").

[221] Joseph Poon & Thaddeus Dryja, *The Bitcoin Lightning Network: Scalable Off-Chain Instant Payments* 2 (2016) ("If Bitcoin is to replace all electronic payments in the future, and not just Visa, it would result in outright collapse of the Bitcoin network, or at best, extreme centralization of Bitcoin nodes and miners to the only ones who could afford it."); *see generally* Aaron Van Wirdum, *The History of Lightning: From Brainstorm to Beta*, BITCOIN MAGAZINE (Apr. 4, 2018) https://bitcoinmagazine.com/articles/history-lightning-brainstorm-beta [https://perma.cc/9BU2-4ZUF] [hereinafter *The History of Lightning*] (providing a brief history of the Lightning Network).

ever, under the current legal framework, the ECB may lack the competence to regulate or influence node operators directly if such operators are not part of credit institutions or payment systems. The ECB may only do so through indirect channels, where regulation would focus on the applications, use-cases, and businesses that are being developed around the open-source cryptocurrency protocols.[222]

Third, a more interesting feature of indirect regulation that makes it particularly suitable for the regulation of cryptocurrencies is its relatively decentralized nature.[223] In this respect, crafting appropriate indirect regulatory mechanisms for cryptocurrencies requires identifying the financial institutions that have the most consistent, continuous, and day-to-day relationships with cryptocurrencies.[224] Identifying these institutions means identifying those equipped with sufficient knowledge and understanding of the industry and their activities in the financial markets.[225] These are the very institutions that can potentially

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[222] *See* Michèle Finck, *Blockchains: Regulating the Unknown*, 19 GER. L.J. 665, 689 (2018) (highlighting examples of similar ideas in a slightly different context); Julie A. Maupin, *Mapping the Global Legal Landscape of Blockchain and Other Distributed Ledger Technologies*, *in* CENTRE FOR INTERNATIONAL GOVERNANCE INNOVATION NO. 149 1 (2017) (examining legal, regulatory, and policy challengers of different categories of use-cases). There are improvements on the Bitcoin protocol and also second layer solutions that promise to make bitcoin useful for all the above-mentioned purposes. *See* William J. Luther & Lawrence H. White, *Can Bitcoin Become a Major Currency?*, (George Mason Univ. Dep't of Econ., Working Paper No. 14-17, 2014) (providing an overview of two such business improvement called "market exchange pricing" and "instantaneous exchange facilities"); *see also* Jimmy Song, *Bits Denomination BIP*, GITHUB (Dec. 22, 2017), https://github.com/bitcoin/bips/blob/master/bip-0176.mediawiki [https://perma.cc/3ELS-CG5E] (illustrating how changes in Bitcoin denomination would improve the overall Bitcoin protcol).

[223] *See* Julia Black, *Decentring Regulation: Understanding the Role of Regulation and Self-Regulation in a 'Post-Regulatory' World*, 54 CURRENT LEGAL PROBS. 103,104–05 (2001) (providing an indepth look into the pros and cons of decentralization and self-regulation).

[224] *See id.* at 134–35 (identifying various regulation-implementing institutions and the nature of their regulations).

[225] In this sense, indirect regulation becomes very similar to regulation by standards, because it relies on decentralized knowledge. For more information about how standards involve utilizing such knowledge. *See* Hans-Bernd Schafer, *Legal Rules and Standards*, *in* 1 THE ENCYCLOPEDIA OF PUBLIC CHOICE 347, 347–50 (Charles K. Rowley & Friedrich Schneider eds., 2004) (exemplifying the court system as a forum where decentralized knowldege helps

be used as 'surrogate regulators' delegated with regulatory functions from the government agencies.[226] In addition to increasing the efficiency of regulation by providing incentives to surrogate regulators to compete with each other, since indirect regulation of cryptocurrencies would be implemented by various multiple banks and payment institutions, it provides for the possibility of decentralized implementation and enforcement of rules that are initially applied to the banking and payment sectors.[227] This can help mitigate the *knowledge problem* that exists in most centralized regulatory agencies and make regulation less vulnerable to regulatory capture.[228]

In the following sections, we study the potential impact of cryptocurrencies on banking and payment systems and the venues for the implementation of indirect regulatory measures towards cryptocurrencies by the ECB by focusing on its regulatory, supervisory, and oversight powers over credit institutions and payment systems. The final section will be dedicated to the indirect technical measures that can be taken to address certain risks posed by cryptocurrencies to central banking.

C. Indirect Regulation through Banking and Payment Systems

The predominant features of decentralized and permission-less cryptocurrencies, the limitations of direct regulation and the constraints on the ECB's scope of competence, mean that indirect regulation of cryptocurrencies would be the most feasible and effective regu-

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turn "imprecise standards into precise rules"); *see generally* F. A. Hayek, *The Use of Knowledge in Society*, 35 AM. ECON. REV. 519, 521 (1945) (discussing the benefits of centralizing all knowledge in one entity or having it dispersed amongst individuals).

[226] Nabilou & Pacces, *supra* note 72, at 206 ("Such an approach to indirect regulation can be seen as a form of delegation of regulatory functions from regulatory agencies to the stakeholders of a given activity. These stakeholders play the role of surrogate regulators.").

[227] *See* Black, *supra* note 225, at 105–12 (describing the dynamic relationships that exist between regulators and regulatees which may benefit from decentralized implementation).

[228] *See* Hayek, *supra* note 227, at 524–25 (identifying centralized knowledge in one entity as an issue because most problems must be solved in the moment by individuals).

latory approach.[229] Indirect regulation of cryptocurrencies would circumvent the difficulties of direct regulation and instead relegate them to a network of decentralized banks and payment institutions to address those problems.[230] For example, instead of regulating tokens issued on permissionless blockchains, indirect regulation may focus on the regulation of wallet providers or exchanges, which could be a more practical solution.[231] In this case, regulation targets the interface between cyberspace and the real world.[232] This is in line with the old tradition in financial regulation where the regulation of financial markets and institutions has relied on gatekeepers.[233]

With respect to indirect regulation, although regulation may not be able to touch the Bitcoin Network itself, it applies at the use-

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[229] BANK FOR INT'L SETTLEMENTS, ANNUAL ECONOMIC REPORT 107 (2018) (critiquing the inefficiencies and constraints in the current system that leave indirect regulation as the only feasible regulatory approach).

[230] Sanctions regimes, where the indirect regulation has proven its relative effectiveness, is a case in point. Within such regimes, where the activity in question is out of reach of the regulator, the regulator targets the industry over which it has jurisdiction and sanctions the transactions between the regulated entities and those outside its regulatory reach (also known as secondary boycotts or sanctions); *see* KERN ALEXANDER, ECONOMIC SANCTIONS: LAW AND PUBLIC POLICY 15 (2009) (detailing how this regulatory approach and secondary boycots function).

[231] *See* Jason Albert, *What's Next for Blockchain: Technology, Economics and Regulation*, MICROSOFT: EU POLICY BLOG (June 20, 2016) https://blogs.microsoft.com/eupolicy/2016/06/20/whats-next-for-blockchain-technology-economics-and-regulation/ [https://perma.cc/9SH3-ARBC] ("Both transmission of virtual currency and entering into a smart contract can be achieved through transfer of a token on the blockchain. But it only makes sense to regulate the former . … [T]he same risks simply aren't present when the token represents a smart contract, an item in a supply chain, or another kind of asset."). The existing examples of this approach are the warnings issued by regulators (such as the EBA and the Commission de Surveillance du Secteur Financier (CSSF) of Luxembourg) discouraging banks that engage or plan to engage in cryptocurrency business from doing so.

[232] *See id.* (emphasizing the need to focus regulation on blockchain matters such as virtual currency transmission and data privacy which relate to similar non-blockchain issues).

[233] Despite the merits of this regulatory approach in that it is directed to identifiable entities, the problem of regulatory arbitrage would still be an obstacle to the success of such a regulatory approach. *See* Part 1 *supra* (discussing the general functions of the ECB).

case levels[234] and regulates the entities and intermediaries that enable the interface and interaction between cryptocurrencies and fiat currencies on cryptocurrency schemes with bidirectional flows.[235] In the future, there would be several scenarios in which banks might engage in payment services using bitcoin or other cryptocurrencies.[236] For example, as second-layer payment solutions are being developed for bitcoin, banks might engage in the second-layer payment channels by running full nodes on the Lightning Network, essentially providing liquidity in bitcoin.[237] Whether running such nodes and engaging in transactions in the second-layer payment channels would mean that the bank engages in the provision of retail payment services and the application of payment laws should be triggered, and whether protocol layer payments qualify as (wholesale) payments system remain open questions.[238] For the purposes of this Article, it seems that such developments would enable regulators to focus on the relatively centralized nodes on such networks.[239]

The role of indirect regulation is particularly important in the context of emerging smart contracts on cryptocurrency schemes and their blockchains.[240] The execution of such contracts is often dependent on the external validation of specific factual events (e.g., the

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[234] DIGITAL INNOVATION IN FINANCIAL SERVICES, *supra* note 95, at 38 ("Technology iteslf is neutral, and it is the outcomes it can achieve, when applied to specific uses, that will largely determine its regulation").

[235] *Id.* at 88 (speculating that cryprocurrencies and their use and impact on market integrity and stability will be ripe for regulation).

[236] *See generally* Poon & Dryja, *supra* note 223 (describing the various payment service networks currently available for cryptocurrencies).

[237] *See id.* (describing the sealing solutions provided by the Lightning Network); *cf.* Frances Coppola, *Lightening Network May Not Solve Bitcoin's Scaling 'Trilemma'*, COINDESK (Jan. 20, 2018, 12:20 AM), https://www.coindesk.com/lightning-network-may-not-solve-bitcoins-scaling-trilemma [https://perma.cc/K986-RXVD] (providing a critique of the Lightening Network for lack of liquidity).

[238] *See* Poon & Dryja, *supra* note 223, at 47 (explaining how nodes would be utilized in running payment services for cryptocurrency).

[239] *See* Poon & Dryja, *supra* note 223, at 48 (discussing how the key central nodes and their routes would be the primary focus of any payment network).

[240] Primavera De Filippi & Samer Hassan, *Blockchain technology as a regulatory technology: From Code is Law to Law Is Code*, 21 FIRST MONDAY 1, 3 (2016) ("As a result of these technological advances, the lines between what constitutes a legal or technical rule becomes more blurred, since smart contracts can be used as both a support and as a replacement to legal contracts").

actual transfer of the personal property), which are necessarily determined by trusted intermediaries (i.e., oracles).[241] In these cases, not only can reliance on oracles increase the level of trust of transactions on the blockchain, but they also become choke points, where law can target blockchain transactions.[242] In addition to the oracles, which facilitate on-chain transactions, indirect regulation, which targets intermediaries, can best be applied to off-chain transactions, where intermediaries are involved in the transaction and the transaction is not broadcast to the blockchain.[243] In contrast, in most on-chain transactions, where no intermediary is involved and no external validation is required, indirect regulation would be of limited use.[244]

IV. The ECB, Payment Systems, and Cryptocurrencies

Ensuring price stability requires the central bank to have mechanisms at its disposal to control inflation and the exchange rate and to supervise the banking system as it plays a significant role in money creation and as a transmission belt for monetary policy.[245] Accordingly, every legal system affords central banks with tools to operationalize such mechanisms and achieve the price stability objective.[246] For example, controlling inflation requires monetary policy tools and since an efficient and well-functioning payment, clearing, and settlement system plays a critical role in the operational efficiency of the monetary policy transmission,[247] and as such is crucial to the

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[241] *See id.* at 16 ("Smart contracts will always and necessarily have to rely on a trusted intermediary (or 'oracle') whenever they need to interface with the real world to provide external validation").

[242] *Id.* at 16–17 (elaborating on how oracles can provide "choke points" where the legal system can apply itself in the context of a breach of contract).

[243] *See generally* Poon & Dryja, *supra* note 223, at 226–27 (describing possible regulation solutions for off-chain transactions).

[244] *See* Athanassiou, *supra* note 73 (discussing the process by which indirect regulation utilizes intermediaries).

[245] *See* Jordan, *supra* note 102, at 2 ("Central bank money, like all nominally denominated money, is subject to the risk of inflation, in other words to the risk of losing in value as a result of rising prices for goods and services."); Pieters, *supra* note 27, at 24 (discussing how central banks use monetary policy to stabilize currency exchange rates).

[246] *See* SCHELLER, *supra* note 66, at 68–70 (discussing the ECB regulatory powers and tools at its disposal for accomplishing its mandate).

[247] *Id.* at 86 (outlining the structure of monetary policy operations for the Eurosystem).

success of the ECB's monetary policy and price stability objectives, the provision, regulation, and oversight of the payment system have also been included in the basic tasks of the ECB.[248]

The ESCB's competence in the area of payments includes ensuring safe and efficient payment systems, which consists of making regulation, the *provision* of facilities, and the exercise of oversight powers.[249] Within this system, the Eurosystem has the authority both in a centralized and decentralized manner (by the ECB and NCBs respectively) to oversee retail and wholesale payment systems.[250] More rigorous oversight standards are applicable to the systemically important payment systems, including the systemically important retail payment systems (SIRPS).[251] In what follows, we highlight the increasing interconnectedness between conventional payment systems and cryptocurrencies that would affect conventional payment systems and eventually trigger action by central banks.[252]

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[248] *See* THE PAYMENT SYSTEM, *supra* note 115 (describing the tasks assigned to the ECB in their mandate including maintaining stability in the value of its currency and maintaining healthy competition between banks within the system).

[249] *Id.* at 309 ("From these legal bases, it can be concluded that the competence of the ECB in this area comprises two elements. One is the task of ensuring safe and efficient payment systems (including the provision of facilities), and the other is the exercise of oversight powers.").

[250] EUROPEAN CENTRAL BANK, REVISED OVERSIGHT FRAMEWORK FOR RETAIL PAYMENT SYSTEMS 1 (2016) ("Eurosystem oversight of retail payment systems has been based on the oversight standards for euro retail payment systems, which, in turn, were based on the Core Principles for Systemically Important Payment Systems.").

[251] *Id.* at 3 (describing classes of payment systems subject to Eurosystem oversight). *See also* European Central Bank Regulation 795/2014, art. 1, 2014 O.J. (L 217) 23.7.2014 16, 16-30 (EU) [hereinafter *SIPS Regulation*] ("This Regulation covers SIPS, including both large-value payment systems and retail payment systems of systemic importance.").

[252] *See infra* Section 4.1 (discussing emerging interconnections between conventional payment systems and cryptocurrencies).

A. Emerging Interconnections between Conventional Payment Systems and Cryptocurrencies

Risks in payment systems include credit risk, liquidity risk, operational risk, legal risk, and systemic risk.[253] To address such risks, payment systems in Europe rest on an edifice of robust institutional and legal infrastructure.[254] In addition to the laws and regulations regarding the retail payment systems, there is a well-established legal framework, including ECB guidelines and decisions, for the wholesale payment systems to address operational, liquidity, and counterparty risks as well as settlement finality risks.[255] However, this legal framework does not apply to payments using cryptocurrencies.[256] In Europe,

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[253] THE PAYMENT SYSTEM, *supra* note 115, at 115–130 (discussing variety of credit-related risks at play in payment system oversight);*see also* Phoebus Athanassiou, *Impact of Digital Innovation on the Processing of Electronic Payments and Contracting: An Overview of Legal Risks* 16–18 (ECB Legal Working Paper Series 16, Oct. 2017) (describing core legal risks related to use of cryptocurrencies as payment media).

[254] These regulations are collectively to address the problems arising from information asymmetry (consumer protection, such as prohibition on blending in interchange fees), enhancing competition among payment service providers (PSPs), and among PSPs, banks and Third Party Payment Service Providers (TPPs) (such as interchange fee regulation, promoting competition by transparency requirements especially for merchant, prohibition on product bundling, and protecting against the systemic risks in the wholesale payments). An additional set of directives and regulation attempts to address concerns about financial crime using payment system (such as AML, CFT, KYC regulations), access to payment accounts (payment accounts directive), user protection, by imposing asset segregation rules and limitations on fees, and ensuring finality of transactions and ultimately the trust in the payments system to achieve payment system stability objective. *See* Hossein Nabilou, *The Dark Side of Licensing Cryptocurrency Exchanges as Payment Institutions*, 14 L. & FIN, MKTS. REV. 39 (2019) [hereinafter *The Dark Side of Licensing*] (addressing "[r]isks in the traditional fiat-based payment systems include[ing] credit risk, liquidity risk, operational risk, legal risk, and systemic risk").

[255] In particular, this framework is of utmost importance in systemically important payment systems (SIPS) and in wholesale payment systems such as Target2 (Trans-European Automated Real-time Gross Settlement Express Transfer System), T2S (Target2-Securities), CLS (Continuous Linked Settlement), and provides legal certainty on collateral and finality of settlements. *Id.* (manuscript at 4) (discussing role of and risks associated with SIPS).

[256] Except those rules applicable to financial fraud or financial crime. See *Digital Innovation in Financial Services, supra* note 95, at 86–88, for a

the Payment Services Directive 2 (PSD2),[257] which provides the regulatory framework for payment institutions, entrusts the competent authorities of the home Member State with the authorization of payment institutions.[258] Some Member States have authorized certain cryptocurrency exchanges as payment institutions.[259] For example, Bitstamp Europe S.A. and bitFlyer Europe S.A., which are prominent cryptocurrency exchanges, have been granted payment institution licenses in Luxembourg.[260] However, the legal basis for granting such authorization remains unclear.[261]

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similar argument. *See also* Asress Adimi Gikay, *Regulating Decentralized Cryptocurrencies under Payment Services Law: Lessons from European Union Law*, 9 J. L., TECH. & THE INTERNET, 20–21 (2018) (discussing lack of regulation in EU's SEPA regime for cryptocurrencies); NOAH VARDI, *Bit by Bit: Assessing the Legal Nature of Virtual Currencies*, *in* BITCOIN AND MOBILE PAYMENTS: CONSTRUCTING A EUROPEAN UNION FRAMEWORK 56 (Gabriella Gimigliano ed. 2016) (arguing that Virtual currencies, on the contrary, lack both a normative defi nition and broader still, any form of legal regulation.).

[257] Council Directive 2015/2366 of Nov. 25, 2015, Payment Services in the Internal Market, Amending Directives 2002/65/EC, 2009/110/EC and 2013/36/EU, and Regulation (EU) No. 1093/2010, and Repealing Directive 2007/64/EC, 2015 O.J. (L 337) 35, 35–37 (EU) [hereinafter PSD2] (reviewing the legal framework for payment systems in the European Union).

[258] *Id.* at art. 5, 60–63 (outlining the application requirements for payment institutions).

[259] *The Dark Side of Licensing, supra* note 256, at 40 (2019) (naming different jurisdictions that include cryptocurrency in their regulatory schemes).

[260] *Id.* (providing Luxembourg as an example of a Member State that issued a license to cryptocurrency exchanges).

[261] At least indirectly, one may surmise that the decision to grant a payment institution license is backed by the reasoning that cryptocurrencies are money. In its communiqué on virtual currencies, dated 14 February 2014, the Luxembourg regulator, i.e., Commission de Surveillance du Secteur Financier (CSSF), states that "'virtual' currencies are considered as money, since they are accepted as a means of payment of goods and services by a sufficiently large group of people. …" *Newsletter*, COMM. DE SURVEILLANCE DU SECTEUR FINANCIER (Comm. de Surveillance du Secteur Financier, Luxembourg), Feb. 2015, at 4. The CSSF goes on to point out that virtual currencies are "scriptural money as opposed to cash in the form of banknotes and coins. The scriptural nature does not require a tangible writing, similarly to electronic documents or signatures that do not require paper. Virtual currencies may thus be electronic money, but not necessarily within the meaning of the European Directive 2009/110 which provides for a definition of electronic money limited to its own scope." *See id.*

PSD2 defines a payment institution as "a legal person that has been granted authorisation … to provide and execute *payment services* throughout the Union."[262] Therefore, the definition of a payment institution depends on the definition of "payment services" in PSD2.[263] The Annex I of the PSD2 defines payment services as services that enable *cash* placement or withdrawal on or from a payment account, "as well as all the operations required for operating a payment account."[264] Furthermore, providing services such as execution of "payment transactions," and *money* remittance fall within the definitional scope of payment services.[265]

A "payment transaction" is defined in the PSD2 as "an act, initiated by the payer or on his behalf or by the payee, of placing, transferring or withdrawing *funds*, irrespective of any underlying obligations between the payer and the payee."[266] Therefore, the determination of whether a cryptocurrency exchange can be considered a payment institution boils down to the definitions of the words "cash," "fund," and "money."[267] Cash and money are automatically excluded as under the current payment laws, cryptocurrencies can neither be considered cash nor money.[268] However, the closest term that could be associated with cryptocurrencies is the word "fund," which the PSD2 defines as "banknotes and coins, scriptural money or electronic money as defined in point (2) of Article 2 of Directive 2009/110/EC."[269]

Bitcoin clearly falls outside the definitions of banknotes, coins, and scriptural money.[270] Nonetheless, intuition may drive us to

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[262] PSD2, *supra* note 259, art. 4(4) (emphasis added).

[263] *See id.* at art. 4(3)–(4) (defining "payment service" and "payment institution," respectively).

[264] *Id.* at Annex I (defining payment services).

[265] *See id.* at art. 4(3) and Annex I (outlining criteria for "payment service.").

[266] *Id.* at art. 4.

[267] *See id.* at art. 4(25) (defining "funds," which includes "banknotes and coins").

[268] *See id.* at art. 3 (excluding cash from the focus of the directive).

[269] *Id.* at 58.

[270] *See* European Banking Auth., Rep. With Advice for the European Commission on Crypto-assets, at 4, (Jan. 9, 2019) ("[B]ased on the analysis conducted by the EBA, typically crypto-assets fall outside the scope of EU financial services regulation (the EBA identifies in this report only limited cases in which crypto-assets may qualify as electronic money)."). In ECB's opinion of 26 April 2006 on a proposal for a directive on payment services in the internal market (ECB/2006/21) (2006/C 109/05), the ECB suggests that the proposal should include a definition of scriptural money. *Opinion of the*

confuse bitcoin and cryptocurrencies with the concept of electronic money (e-money).[271] However, the e-money directive[272] defines electronic money as "electronically, including magnetically, stored monetary value as represented by a claim on the issuer which is issued on receipt of funds for the purpose of making payment transactions … and which is accepted by a natural or legal person other than the electronic money issuer."[273] As bitcoin and many of its copycats, do not represent any claim on any issuer, legislation does not classify them as e-money.[274]

As under the current European legal framework for payments, cryptocurrencies cannot be classified as "funds,"[275] the applicability of

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European Central Bank of 26 April 2006 on a Proposal for a Directive on Payment Services in the Internal Market, 2006 O.J. (C 109) 10, 18. ("It is suggested that a definition of scriptural money should be established (in the definitions article), bearing in mind that only central banks and credit institutions (which include e-money institutions) may hold such funds."). However, it specifies that "only central banks and credit institutions (which include e-money institutions) may hold scriptural money." *Id.* The PSD2 does not contain any definition of scriptural money. *Id.* (neglecting to decline the term 'scriptural money'). However, it seems that the term scriptural money can hardly be stretched to include cryptocurrencies. *Id.* at 23 (defining 'scriptural money' as "deposit balances held on an account at a credit institution or a central bank").

[271] *See* EUROPEAN CENT. BANK, VIRTUAL CURRENCY SCHEMES: A FURTHER ANALYSIS, at 21 (2015) [hereinafter ECB 2015 Report] (suggesting that users of a payment system might confuse virtual currencies with other forms of currency, particularly e-money given the apparent similarity).

[272] *See* Directive 2009/110/EC of the European Parliament and of the Council of 16 September 2009 on the Taking Up, Pursuit and Prudential Supervision of the Business of Electronic Money Institutions amending Directives 2005/60/EC and 2006/48/EC and Repealing Directive 2000/46/EC, 2009 O.J. (L 267) 7, 11 [hereinafter, E-Money Directive] (addressing legislation for electronic money).

[273] *Id.*

[274] ECB 2015 Report, *supra* note 273, at 25 (suggesting virtual currencies are not e-money). Although some other cryptocurrencies, depending on their features may qualify as e-money. European Banking Auth., *supra* note 272, at 14 ("Should a firm propose to carry out, using DLT, a 'payment service' as listed in Annex I to the PSD2 … with a crypto-asset that qualifies as 'electronic money' such activity would fall within the scope of the PSD2.").

[275] European Banking Auth., *supra* note 272, at 14 ("[C]rypto-assets do not fall within the definition of 'funds' set out in point (25) of Article 4 of the

European payment laws to cryptocurrency exchanges cannot be taken for granted.[276] In addition, even if the European payment services laws would be applicable to cryptocurrency exchanges in their entirety, they would still be short of addressing certain idiosyncratic risks to which cryptocurrency exchanges are subject.[277] Such idiosyncratic risks include the risks of reliance of cryptocurrency exchanges on illiquid and volatile settlement assets which are not convertible to CeBM and the risks of settlement finality that exists in major cryptocurrency blockchains.[278]

1. The Volatility of the Settlement Asset

There are two main problems with blockchain-based cryptocurrencies such as bitcoin that give rise to high levels of volatility of their settlement assets in times of illiquidity.[279] First is the fixed supply schedule of these cryptocurrencies, and the second is the possibility of

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PSD2 unless they qualify as 'electronic money' for the purposes of the EMD2.").

[276] *See generally* Asress Adimi Gikay, *Regulating Decentralized Cryptocurrencies Under Payment Services Law: Lessons from European Union Law*, 9 CASE W. RES. J.L. TECH. & INTERNET 1, 20–28 (2018) (discussing the response by legislative and judicial bodies in the European Union to the regulatory difficulties posed by the rapid evolution and definitional complexity of virtual currencies).

[277] *See* Robleh Ali et al., *Innovations in Payment Technologies and the Emergence of Digital Currencies*, BANK OF ENG. Q. BULL., Q3 2014, at 262, 270–72 (describing the differences between the risks inherent in traditional payments systems, which are centralized, and the payments systems employed by virtual currencies, which are decentralized).

[278] *See, e.g.*, Rebecca M. Bratspies, Cryptocurrency and the Myth of the Trustless Transaction, 25 MICH. TECH. L. REV. 1, 3, 16–18 (2018) (footnotes omitted) (suggesting that cryptocurrencies have so far not fulfilled their promise of becoming a viable replacement for fiat currency because "[i]t turns out that cryptocurrency transactions can be slow and expensive, because the core technology, the blockchain, scales poorly," and highlighting the extreme volatility of Bitcoin and other cryptocurrencies, which has so far made them impractical means of exchange).

[279] *See, e.g.*, Dan Awrey & Kristin van Zwieten, *The Shadow Payment System*, 43 J. CORP. L. 775, 778–79 (2018) (using the failure of the Mt. Gox cryptocurrency exchange in 2014 as an example to highlight the liquidity problems inherent in cryptocurrency exchanges).

bidirectional flows between cryptocurrencies and fiat money.[280] The problem would arise if licensed cryptocurrency exchanges use relatively illiquid and highly volatile cryptocurrencies as their settlement asset over which neither the ECB nor the NCBs have any control.[281] The problem may become even more acute if such exchanges would become increasingly intertwined with the regulated payment institutions.[282] If such exchanges that use unconvertible settlement assets—that have no access to LOLR of any central bank or authority and that are illiquid and highly volatile—take more payment functions and become large enough, they would metamorphose into contagion channels that would channel the liquidity crises from cryptocurrency exchanges to the banking and payment systems.[283]

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[280] *See id.* ("The risks that the shadow payment system poses to customers flow principally from the prospect of delayed conversion or transfer of funds (*illiquidity*) and the potential write-down of these funds where they are characterized as unsecured liabilities in the context of any bankruptcy proceeding (*loss of value*).")

[281] *See* BANK FOR INT'L SETTLEMENTS, *Core Principles for Systemically Important Payment Systems* 35 (2001) ("Particular considerations arise if a systemically important payment system uses claims on a central bank to settle payments in a currency which the central bank does not itself issue. The settlement asset in this case can be subject to the risk that participants' holdings of the settlement asset might not always be readily transferable into claims on other institutions of their choice.").

[282] *See* Awrey & van Zwieten, *supra* note 281, at 779 (discussing the systemic risks posed to traditional financial intermediaries and central banks by the continued growth and greater acceptance of cryptocurrencies as "shadow" payment methods).

[283] *See* Nicholas A. Plassaras, *Regulating Digital Currencies: Bringing Bitcoin within the Reach of IMF*, 14 CHI. J. INT'L L. 377, 380–31 (2013) (discussing the systemic risks posed to the economic system by speculative attacks on virtual currencies such as Bitcoin, which fall outside the control and protection of the IMF and central banks, which would normally function as lenders of last resort). In addition, the failure of such cryptocurrency payment institutions/exchanges would also pose reputational risks to the EU license brand of payment institutions. *See* EUROPEAN CENT. BANK, VIRTUAL CURRENCY SCHEMES 45 (2012) [hereinafter ECB 2012 Report] (discussing the "considerable" reputational risks to the ECB should a virtual currency fail, even if the ECB were not responsible); Ciara Moloney, *Cryptocurrency: Risk Management Overview* (Feb. 15, 2019), Willis Towers Watson, https://www.willistowerswatson.com/en-US/Insights/2019/02/cryptocurrency-risk-management-overview [https://perma.cc/WZ2A-4XVY] (suggesting that there are major reputational risks for established banks and other financial institutions

Furthermore, the increasing number of payment institution licenses for cryptocurrency exchanges would increase the magnitude of interconnectedness between cryptocurrency payment institutions and conventional ones, and to the extent cryptocurrency and payment activities are not separate, could ultimately draw central banks' interest in regulating cryptocurrencies.[284] A viable policy option to stem the rise of such contagion channels would be for central banks and other NCAs to impose structural separations of cryptocurrency payment systems from regulated payment systems.[285] In addition, central banks, including the ECB, can deny access to their infrastructure by the banks and payment institutions that have certain amounts of exposure to cryptocurrency exchanges that are above the amount set by the ECB or NCBs.[286]

In addition to the risks associated with the settlement asset, cryptocurrency payments are mainly gross and (near) real time.[287]

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as they begin dabbling in cryptocurrency transactions, and "[a]ny negative or adverse regulatory event could trigger a further loss of confidence in the engagement of cryptocurrency").

[284] *See* ECB 2015 Report, *supra* note 273, at 4–5 (highlighting the fact that "[a] number of international authorities have developed an interest in [virtual currencies]" and "[s]everal central banks and financial and supervisory authorities around the world have warned users of the risks related to holding and transacting virtual currencies, provided clarifications on the legal status, started regulating certain activities or issued an outright ban").

[285] EBA Opinion on 'Virtual Currencies', at 44 (July 4, 2014), https://eba.europa.eu/documents/10180/657547/EBA-Op-2014-08+Opinion+on+Virtual+Currencies.pdf [perma.cc/H4SZ-X2KE] (suggesting that central banks, such as the European Central Bank should recognize the different structural mechanisms in place that make and regulate cryptocurrencies differently than other payment methods).

[286] Consolidated Version of the Treaty on the Functioning of the European Union art. 119, June 7, 2016, 2016 O.J. (C 202) 59 (stating that the document only concerns the currency of the euro).

[287] Hugh Son, *JP Morgan Is Rolling Out the First US Bank-Backed Cryptocurrency to Transform Payments Business*, CNBC (Feb. 14, 2019, 7:13 PM), https://www.cnbc.com/2019/02/13/jp-morgan-is-rolling-out-the-first-us-bank-backed-cryptocurrency-to-transform-payments--.html (discussing JPM Coin, Umar Farooq notes that "Instead of sometimes taking more than a day to settle because institutions have cut-off times for transactions and countries operate on different systems, the payments will settle in real time, and at any time of day").

Hence, they may be subject to substantial liquidity risks.[288] Concerns about liquidity risks have been raised about bitcoin in the sense that it is impossible to have full decentralization, a fixed money supply, and sufficient liquidity simultaneously.[289] As of this writing, there has been no documented evidence for the potential risks arising from the interconnectedness of cryptocurrency exchanges with conventional payment institutions that would arise from the illiquidity in cryptocurrencies. However, increasing the involvement of banks with cryptocurrency payment institutions could potentially result in spillover risks from the latter to the former.

2. Finality of Settlements

The probabilistic finality in certain cryptocurrencies, such as bitcoin, is another risk in using cryptocurrencies for payment purposes that is not dealt with by the existing payment laws.[290] The probabilistic finality in Bitcoin blockchain means that there is a likelihood that the latest transactions that are embedded in the Bitcoin blockchain by miners may be undone or some bitcoins may be double-spent due to the creation of a fork in the blockchain.[291] However, as the block height increases over a given transaction, the probability of its reversal diminishes due to the PoW algorithm used in the Bitcoin block-

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[288] Loi Luu, *Solving the Liquidity Challenge of Decentralized Exchanges*, COINDESK (Aug. 14, 2017, 11:15 UTC), https://www.coindesk.com/solving-liquidity-challenge-decentralized-exchanges ("[A] transaction in bitcoin, or any other cryptocurrency, has a much greater effect on the cryptocurrency's value [as compared to cash]. This is because of the market's lack of liquidity. The amount of cryptocurrency available on a specific trading platform can run out, requiring the buyer to complete the transaction at 1–10 percent more than expected.").

[289] Coppola, *supra* note 239 ("The problem is, it isn't possible to have full decentralization, a fixed money supply and sufficient liquidity for an efficient payments system. This is bitcoin's 'trilemma.' ").

[290] The Financial Markets and Insolvency (Settlement Finality) Regulations 1999, SI 1999/2979 (Eng.) (providing an example of existing legislation on settlement finality that does not mention any type of cryptocurrency).

[291] *Cryptocurrencies: Looking Beyond the Hype*, *supra* note 31, at 102 ("The lack of payment finality is exacerbated by the fact that cryptocurrencies can be manipulated by miners controlling substantial computing power, a real possibility given the concentration of mining for many cryptocurrencies.").

chain.[292] Given this relationship, it would be safe to assume that *de facto* finality occurs after six confirmations, as unwinding six blocks by attackers would require very high amounts of investment in energy.[293] Hence, the burgeoning commercial customs within the industry view the build-up of six confirmations as the moment after which the transactions are deemed to be final.[294] According to the mainstream practice, as soon as a transaction is broadcast to the Bitcoin blockchain, the receiving wallet receives a notification that confirms that an instruction to pay is received in the Bitcoin blockchain, but the payment is only final after there are six confirmations.[295]

However, actual, technical, or *de facto* finality should not be confused with legal or *de jure* finality. The technical settlement in virtually all payment systems, including cash and other electronic payments, is probabilistic. This is because the possibility of taking the cash back by brute force or reversing an online transaction cannot be ruled out from a technical aspect. However, highlighting the logical and *de facto* impossibility of the finality of transactions does not necessarily signify that a payment cannot become *legally* final, meaning that the legal challenges would not be able to threaten the validity of the payment *ex-post*.[296] In other words, *de facto* probabilistic finality is

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[292] Alexis Gauba, *Finality in Blockchain Consensus*, MEDIUM (Aug. 30, 2018), https://medium.com/mechanism-labs/finality-in-blockchain-consensus-d1f83c120a9a ("Probabilistic finality refers to the type of finality provided by chain-based protocols (eg. Bitcoin's Nakamoto consensus), in which the probability that a transaction will not be reverted increases as the block which contains that transaction sinks deeper into the chain. The deeper the block, the more likely that the fork containing that block is the longest chain. This is why it is recommended to wait until a transaction is 6 blocks deep into the Bitcoin blockchain, which takes around an hour, before following through on that transaction, to ensure that there is a very low likelihood of that transaction being reverted.").

[293] Gauba, *supra* note 294..

[294] *Id.*

[295] *Confirmation*, BITCOIN WIKI (Mar. 16, 2018), https://en.bitcoin.it/wiki/Confirmation ("Most exchanges and other merchants who bear the risk from double spending require 6 or more blocks.").

[296] Morten Bech et al., *The Quest for Speed in Payments*, BIS Q. REV., Mar. 2017, at 58, available at https://www.bis.org/publ/qtrpdf/r_qt1703g.pdf ("for some systems payments were revocable within a certain period, adding an element of uncertainty.").

not equivalent to *de jure* probabilistic finality and vice versa.[297] In this sense, the only meaningful difference between transactions occurring within conventional payment systems and ones occurring in cryptocurrency blockchains with probabilistic finality is that the former benefits from legal protections extended to such transactions, whereas the latter does not have any legal protection ensuring its legal finality.[298]

Through time, case law may evolve in a way to presume settlement finality of transactions on Bitcoin blockchain after six confirmations for private-law purposes.[299] However, given the importance of payment systems for financial stability and the systemic risk concerns that might arise from the uncertainty about a transaction's finality, regulatory actions might be the appropriate approach to deal with such an uncertainty. However, current payment laws regarding settlement finality, such as the Settlement Finality Directive,[300] which requires the payment and settlement systems falling within its scope of application to define the moment of entry and irrevocability of the orders and transactions, are not applicable to cryptocurrency payments.[301] The absence of legal protections can give rise to systemic risk if cryptocurrency markets become large enough and intertwined with the conventional payment systems or if more sophisticated

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[297] *Id.* In fact, technically speaking, in most transactions, the real world may not provide 100 percent certainty; therefore, there is a need for the law to intervene and presume that as soon as certain requirements are met, a transaction would be deemed final. As on the Bitcoin Blockchain, similar to any other payment system, the actual transfers are not 100 percent final and immutable, but the law may presume that at certain point in time a transaction becomes final. In other words, the fact that the finality on the Bitcoin Blockchain is not deterministic does not stop the law from presuming the finality of a transaction on its blockchain.

[298] The Financial Markets and Insolvency (Settlement Finality) Regulations, *supra* note 292 (serving as example of legislation that excludes cryptocurrency considerations).

[299] Bech, *supra* note 298 (serving as a potential analogy to the finalization of cryptocurrency payments if compared to finality of credit card payments).

[300] Directive 98/26/EC, of the European Parliament and of the Council of 19 May 1998 on Settlement Finality in Payment and Securities Settlement Systems, arts. 3–5, 1998 O.J. (L 166) 48–49 [hereinafter Settlement Finality Directive] (establishing rules of entry and irrevocability).

[301] *Id.*

financial products and services would be built on top of cryptocurrencies.[302]

V. The ECB, Banking Stability, and Cryptocurrencies

Banks and cryptocurrencies have an uneasy relationship.[303] On the one hand, there is a likelihood that the cryptocurrency-related businesses would grab part of the business of banking.[304] For example, it seems that the first line of business of traditional banking, which is more likely to fall victim to cryptocurrencies, is the provision of payment services, especially the correspondent-banking model of international fund transfers.[305] On the other hand, to avoid such an outcome, banks might take a proactive approach and co-opt cryptocurrency business, even in the provision of payment services.[306]

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[302] The lack of such legal protections may cast a shadow of doubt on the decisions to grant payment institution license to cryptocurrency exchanges and payment service providers. *See* Everette J. et al., *Risks and Vulnerabilities of Virtual Currency*, 2017 Public Private Analytic Exchange Program 18 (2017) ("The regulatory uncertainty and lack of transparency into cryptocurrencies create significant consumer protection vulnerabilities including disruptions to cryptocurrency ecosystems, risks related to unregulated cryptocurrency intermediaries and service providers, fraud schemes, and the irreversibility of transactions.").

[303] Paul Vigna, *Lack of Banking Options a Big Problem for Crypto Businesses*, WALL ST. J. (last updated May 17, 2019 12:34 PM), https://www.wsj.com/articles/lack-of-banking-options-a-big-problem-for-crypto-businesses-11558092600 (discussing the lack of access cryptocurrencies face in the financial system).

[304] Darryn Pollock, *The Future Of Banking: Is It All Bitcoin and Blockchain?*, FORBES (Jul 25, 2019, 05:42 AM), https://www.forbes.com/sites/darrynpollock/2019/07/25/the-future-of-banking-is-it-all-bitcoin-and-blockchain/#19ff2d1f31eb ("Challenger banks, App-banks, mobile payment companies, merchant services aggregator, peer-to-peer payments companies, are all financial services that are looking to take a piece of the pie that traditional banks have held for so long.").

[305] *Id.* (examining the emergence of App-banks as alternatives to banking because they facilitate payments and money transfers).

[306] Chris Isidore, *JPMorgan s Creating Its Own Cryptocurrency*, CNN (last updated Feb.14, 2019), https://www.cnn.com/2019/02/14/investing/jpmorgan-jpm-coin-cryptocurrency/index.html [https://perma.cc/4BC4-R59C] (discussing an example of a national bank launching its own cryptocurrency).

There are many channels through which banks may be involved in cryptocurrency activities.[307] Examples would include direct ownership of cryptocurrencies, market making, lending against cryptocurrency collateral, engaging in clearing of trading cryptocurrency derivative instruments, lending to cryptocurrency businesses, underwriting ICOs, and providing custody wallet or trading platforms in cryptocurrencies.[308] An exhaustive treatment of the dynamics of the interaction between cryptocurrencies and banks goes well beyond the scope of this Article. Suffice it to mention that such business activities may pose new risks to the banking system.[309] As banks play an important role in money creation and allocation of credit as well as in the transmission of monetary policy, a disruption in the banking system can have significant consequences for the supply of money and credit, price stability, and the implementation of monetary policy, which may warrant the ECB's attention to the risks involved in the interaction of cryptocurrencies and banks.[310] Here, we discuss a few hypothetical scenarios about the interaction of the banking system with the cryptocurrency ecosystem in the future, the potential risks arising from such interactions, and the potential venues for ECB intervention.

The first venue for banks to engage in cryptocurrency business is through the recent developments in the scaling issues related to cryptocurrencies, such as bitcoin, by engaging in the business opportunities that are emerging around those new developments.[311] From the

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[307] Pollock, *supra* note 307 (explaining how financial institutions need to start offering blockchain and crypto services to meet eventual mass appeal).

[308] *Report with Advice for the European Commission*, EUR. BANKING AUTH. 22–23 (2019), https://eba.europa.eu/sites/default/documents/files/documents/10180/2545547/67493daa-85a8-4429-aa91-e9a5ed880684/EBA%20Report%20on%20crypto%20assets.pdf?retry=1 [https://perma.cc/3FBF-9FHH].

[309] Pollock, *supra* note 307 (discussing how "challenger banks" are "disrupting the banking hegemony with their customer focus, their everyday usability, and their own technologies").

[310] Jeffrey A. Tucker, *How Will Banking and Credit Work in a CryptoCurrency Economy?*, FOUND. FOR ECON. EDUC. (Oct. 13, 2017), https://fee.org/articles/how-will-banking-and-credit-work-in-a-cryptocurrency-economy/ [https://perma.cc/4NT9-TW3B] (quoting the concerns of Christine Lagarde at the Bank of England Conference in September 2017, including "'[b]ut if these [central] banks were to become less relevant in the new financial world, and demand for central bank balances were to diminish, could monetary policy transmission remain as effective?").

[311] Poon & Dryja, *supra* note 223, at 1–3 (discussing the scalability and trust issues facing bitcoin).

earliest days of bitcoin, scaling issues have been a constant concern that led to polarizing controversies in the bitcoin community.[312] Two main camps emerged on this dividing issue: one supporting vertical scaling solutions or second-layer solutions,[313] the other supporting horizontal scaling solutions or increasing the block size.[314] The

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[312] Bitcoin itself can be viewed as an invention that emerged to overcome social scalability problem in the first place. Although the discussion of this paper is limited to technological scalability, the problem of social scalability stands at the core of the scalability issues in bitcoin. Indeed, the perceived inefficiencies in the PoW can be understood in the balance struck between social scalability and computational scalability. In the Bitcoin Blockchain, the latter is sacrificed to improve the former. *See* Nick Szabo, *Money, Blockchains, and Social Scalability*, UNENUMERATED (Feb. 9, 2017, 9:22 AM), http://unenumerated.blogspot.com/2017/02/money-blockchains-and-social-scalability.html [https://perma.cc/2ZLD-3M5E] ("Instead, the secret to Bitcoin's success is that its prolific resource consumption and poor computational scalability is buying something even more valuable: social scalability.").

[313] *See* ANDREAS M. ANTONOPOULOS, MASTERING BITCOIN: PROGRAMMING THE OPEN BLOCKCHAIN, 299–321 (2017) (ebook) (defining the Counterparty protocol and providing an example of vertical payment channels).

[314] *See* Tom Elvis Jedusor, *Mimblewimble Origin*, GITHUB (July 19, 2016), https://github.com/mimblewimble/docs/wiki/MimbleWimble-Origin [https://perma.cc/4ZL3-B7J3] (explaining the problem of "too much data" and proposed solutions to allow bitcoin to scale); Poon & Dryja, *supra* note 223 ("If [HTLC transactions] become [] the dominant form of transactions which are included on the blockchain, it may become necessary to increase the block size and run a variable blocksize structure and timestop flags."); Aaron van Wirdum, *Mimblewimble: How a Stripped-Down Version of Bitcoin Could Improve Privacy, Fungibility and Scalability All at Once*, BITCOIN MAG. (Aug. 12, 2016), https://bitcoinmagazine.com/articles/mimblewimble-how-a-stripped-down-version-of-bitcoin-could-improve-privacy-fungibility-and-scalability-all-at-once-1471038001 [https://perma.cc/3GUL-U4DK] [hereinafter *Mimblewimble*] (explaining how the proposed Mimblewimble "presents a radical slimming-down of the Bitcoin protocol that could not only dramatically increase privacy and fungibility, but also present significantly more scalability than Bitcoin's current blockchain architecture"); *The History of Lightning*, *supra* note 223 (detailing the development of the Lightning Network to address bitcoin's scaling issues and block-size-limits); *see also* Shiraz Jagati, *Vertical and Horizontal Blockchain Scaling, Explained*, COINTELEGRAPH (Oct. 20, 2019), https://cointelegraph.com/explained/vertical-and-horizontal-blockchain-scaling-explained [https://perma.cc/EUM3-AS4P] (describing horizontal scaling as "changing the core framework of the platform itself [ ] in order to establish a cluster of servers that are capable of handling an increased number of incoming transaction requests with ease").

ensuing civil war among the bitcoin community resulted in the failed SegWit2X, and a hard fork leading to the creation of bitcoin cash (BCH) and subsequent user activated soft fork (UASF) and the activation of SegWit on the legacy chain.[315] Through time, it seems that within the bitcoin community vertical scaling solutions to address bitcoin's scalability problem is gaining traction.[316]

The second-layer solutions to bitcoin's scalability problem are not new phenomena and have already been in the making from the early days of bitcoin.[317] Fractional reserve banking on bitcoin can be considered as an early example of such a scaling solution to bitcoin.[318] In the words of Hal Finney:

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[315] Laura Shin, *Will This Battle For The Soul Of Bitcoin Destroy It?*, FORBES (Oct. 23, 2017, 1:35 PM), https://www.forbes.com/sites/laurashin/2017/10/23/will-this-battle-for-the-soul-of-bitcoin-destroy-it/#21ee126a3d3c (examining bitcoin's most recent split into two chains, one option being the SegWit proposal). Similar controversies happened on the Ethereum's blockchain due to the loss of funds associated with DAO project, resulting in a chain split and the creation of Ethereum and the Ethereum Classic. Alyssa Hertig, *Ethereum's Two Ethereums Explained*, COINDESK (last updated Dec. 11, 2017), https://www.coindesk.com/ethereum-classic-explained-blockchain [https://perma.cc/PT9P-2EVN] (explaining the differences between the Ethereum and the Ethereum Classic).

[316] *See* ANTONOPOULOS, *supra* note 316, at 299–321 (discussing the viability and growing popularity of the Lightning Network). From these new solutions, the Lightning Network, Liquid Network, Sidechains, and other scaling solutions such as Mimblewimble stand out. *See* Jedusor, *supra* note 317 (proposing Mimblewimble as a potential solution to bitcoin's scalability issues); Poon & Dryja, *supra* note 223, at 42 ("Core channels in the Lightning Network can conduct billions oftransactions without a need for significant storage costs."); *Mimblewimble*, *supra* note 317 (explaining the ways Mimblewimble improves bitcoin scalability because it no longer requires a transaction history per coin); *History of Lightning*, *supra* note 317 (providing a history of the evolution of bitcoin's trustless payment channel networks).

[317] Daniel Morgan, *The Great Bitcoin Scaling Debate—A Timeline*, HACKERNOON (Dec. 1, 2017), https://hackernoon.com/the-great-bitcoin-scaling-debate-a-timeline-6108081dbada [https://perma.cc/9SNP-T2ZK] (providing a summary of previous attempts to scale bitcoin's blockchain and providing explanations for failures).

[318] Larry D. Wall, *Fractional Reserve Cryptocurrency Banks*, FED. RES. BANK OF ATL. (April 2019), https://www.frbatlanta.org/cenfis/publications/notesfromthevault/04-fractional-reserve-cryptocurrency-banks-2019-04-25 [https://perma.cc/6J5Q-22AN] (explaining the basics of fractional reserve banking and early attempts to create a bitcoin-based fractional reserve bank).

> [T]here is a very good reason for Bitcoin-backed banks to exist, issuing their own digital cash currency, redeemable for bitcoins. Bitcoin itself cannot scale to have every single financial transaction in the world be broadcast to everyone and included in the block chain. There needs to be a secondary level of payment systems which is lighter weight and more efficient. Likewise, the time needed for Bitcoin transactions to finalize will be impractical for medium to large value purchases. Bitcoin backed banks will solve these problems. They can work like banks did before nationalization of currency. Different banks can have different policies… [s]ome would be fractional reserve while others may be 100% Bitcoin backed. Interest rates may vary… I believe this will be the ultimate fate of Bitcoin, to be the 'high-powered money' that serves as a reserve currency for banks that issue their own digital cash. Most Bitcoin transactions will occur between banks, to settle net transfers . …[319]

In addition to banks and exchanges, bitcoin custody solution providers and Bitcoin debit card providers—which allow the transfers of a bitcoin from a wallet to another within or across companies without using the Bitcoin blockchain—can be considered as part of the second-layer scaling solutions for Bitcoin.[320]

Within the development of the second-layer on Bitcoin, bank involvement in cryptocurrencies could take various forms.[321] Banks

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[319] Hal, COMMENT to *Bitcoin Bank*, SIMPLE MACHINES F. (Dec. 30, 2010, 1:39 AM), https://bitcointalk.org/index.php?topic=2500.msg34211#msg34211 [https://perma.cc/VWH3-A4FB] (answering a question poised to the public over the potential for a Bitcoin bank and certain aspects of how such an entity would function).

[320] *See generally*, Alex Lielacher, *Best Bitcoin and Crypto Custody Providers, Rated and Reviewed for 2020*, BITCOIN MKT. J. (Feb. 8, 2020) https://www.bitcoinmarketjournal.com/best-bitcoin-and-crypto-custody-providers/ [https://perma.cc/ZFQ2-GGM7] (introducing the different Bitcoin and crypto custodians in the market and their typical functions); Felix Küster, *The Best And Safest Crypto Debit and Credit Cards 2020*, CAPTAINALTCOIN (Jan. 24, 2020), https://captainaltcoin.com/bitcoin-debit-cards/ [https://perma.cc/28D2-TDBZ] (providing a basic overview of bitcoin debit-card providers).

[321] *See generally* Antonopoulos, *supra* note 316 (discussing the second layer development on Bitcoin's channels); *see also* Yoav Vilner, *Down The Next Rabbit Hole: Exploring BIockchain's Second Layer*, FORBES (Apr 25, 2019), https://www.forbes.com/sites/yoavvilner/2019/04/25/down-the-next-rabbit-hole-exploring-biockchains-second-layer/#49095f95278f

would operate on the additional layer on the Bitcoin blockchain, and the Bitcoin's base layer itself would function as the highly secure base or settlement layer for the net settlement of the financial obligations arising from the financial transactions conducted on Bitcoin's upper layers.[322] Banks and payment service providers may also evolve into wallet providers, custodians, and node operators supporting payment channels within the Lightning Network.[323]

However, the second-layer payment channels within the Lightning Network may pose different challenges, such as liquidity risks, that would warrant special scrutiny if banking entities would run full nodes or otherwise engage in liquidity provision on the Network.[324] In addition, the transactions on the Lightning Network may provide for higher levels of privacy compared to on-chain transactions.[325] Although the concerns about the liquidity may warrant ECB's involvement in the regulation through discouraging the banking entities in engaging in such activities, the privacy of payments would require regulators'—other than central banks—intervention.[326]

[https://perma.cc/6J3A-SLUU] (describing the advancement the second layer on Bitcoin and the coming technological advancements from this development).

[322] Nik Bhatia, *The Bitcoin Second Layer*, MEDIUM (Aug. 7, 2018), https://medium.com/@timevalueofbtc/the-bitcoin-second-layer-d503949d0a06 [https://perma.cc/E78N-3WSK] (utilizing the metaphor of gold to highlight the abilities of banks to use Bitcoin layers, as well as how Bitcoin, itself could be the initial secure layer, on which the other layers are built upon, like "Lightning" and the secondary layers would be slightly less secure than the primary Bitcoin layer, but more useable).

[323] *See* Poon & Dryja, *supra* note 223, at 54–55 (identifying the potential uses for the Lightning Network as taking over aspects of wallet and custodian operations); VIRTUAL CURRENCY SCHEMES, *supra* note 28, at 39 (speculating on the future of banks borrowing and lending in Bitcoin and their uses); *see also* Hossein Nabilou, *How to Regulate Bitcoin? Decentralized Regulation for a Decentralized Cryptocurrency*, 27 INT'L J. L. & INFO. TECH. 209, 284 (2019) (discussing the technical developments for decentralized regulation on Bitcoin and the potential evolutions it may take).

[324] Coppola, *supra* note 239 ("Lightning could prove as illiquid as bitcoin.").

[325] *Cf.* Rachel Rose O'Leary, *Will Lightning Help or Hurt Bitcoin Privacy?*, COINDESK, (Feb. 26, 2018), https://www.coindesk.com/will-lightning-help-hurt-bitcoin-privacy [https://perma.cc/E2GP-72QH] (commenting on the increased privacy of the Lightning Network's "onion routing" but expressing concern over the potential for privacy issues)

[326] *See generally*, De Filippi, *supra* note 19, at 10–11 (discussing the intersection between decentralized systems, regulation, and privacy); *see also* Hossein

Second, banks may start accepting Bitcoin or other cryptocurrencies as deposits,[327] and as deposit-taking institutions, they may pay interest on the cryptocurrency deposits, or eventually develop a fractional reserve banking model on Bitcoin.[328] Although at the time of this writing, the banking sector does not engage in borrowing and lending cryptocurrencies,[329] this may be subject to change in the future, despite the many risks involved in such transactions.[330] Banks'

Nabilou, *supra* note 326, at 209, 284, 286 (calling for the potential for regulatory intervention into developments in Bitcoin and the issue of liquidity risks for the users).

[327] Although under current legal framework, the word deposit and the legal protections afforded to such banking products are not applicable to cryptocurrencies. *See generally* Nabilou, *supra* note 326 (highlighting the similarities between property which may be valuable and work as deposits for a bank and the current framework which lacks precise applicability to the market); *see also* VIRTUAL CURRENCY SCHEMES, *supra* note 28, at 40 (expressing the risk to users of virtual currency schemes because of the lack of supervision or oversight).

[328] *See* Hal, *supra* note 322 (discussing the generalities of a potential bank which deals in Bitcoin); *see also* VIRTUAL CURRENCY SCHEMES, *supra* note 28, at 39 (considering the possibility of banks dealing in Bitcoin on a fractional reserve system extending credit and charging interest). However, such activities would expose businesses to risks of maturity and liquidity transformation. As in the absence of a LOLR, establishing safeguards to alleviate the risks of maturity and liquidity transformation in decentralized cryptocurrencies would be virtually impossible, engaging in deposit-taking and lending would not be appealing to cryptocurrency businesses. Accordingly, it is less likely that the role of the banking sector in maturity and liquidity transformation would be disrupted by the developments in the cryptocurrency business. VIRTUAL CURRENCY SCHEMES, *supra* note 28, at 38–40 (mentioning the resistance to bank's involvement in cryptocurrency, even with new developments and the inherent riskiness in virtual currency).

[329] However, some lending platforms engage in cryptocurrency lending and some exchanges do margin lending at the moment. *See* Sarah Hansen, *Guide to Top Cryptocurrency Exchanges*, FORBES (June 20, 2018), https://www.forbes.com/sites/sarahhansen/2018/06/20/forbes-guide-to-cryptocurrency-exchanges/#3ddb939d2572 [https://perma.cc/DEP4-34ZT] (summarizing several cryptocurrency exchanges denoting the exchanges which us margin trading and their relation with regulatory authorities and banks); Nabilou, *supra* note 326, at 209, 277, 285 (2019) ("Though some lending platforms engage in cryptocurrency lending and some exchanges do margin lending at the moment.").

[330] VIRTUAL CURRENCY SCHEMES, *supra* note 28, at 39 (speculating on the future of banks borrowing and lending in Bitcoin and their uses).

engagement in such cryptocurrency transactions would pose two distinct, prudential issues. First, the acceptability of cryptocurrencies as collateral and the quantitative and qualitative standards to be used to determine haircuts in accepting their use and reuse as collateral, both in the banking industry and in monetary policy operations of central banks.[331] The second problem would be associated with the absence of LOLR in cryptocurrencies.[332] As fractional reserve banking on Bitcoin would result in liquidity problems, the absence of a LOLR could become problematic.[333] In the Eurozone, the ECB and NCBs have offered LOLR services (equivalent to Fed's discount window) through the marginal lending facility.[334] The reason that the ECB or NCBs can offer such a service is that they have access to unlimited sources of liquidity.[335] Given cryptocurrencies' inherent fixed supply schedule and static money supply, Bitcoin may remove the possibility of an ultimate liquidity provider.[336] Although some projects for stablecoins,

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[331] *See* Nabilou, *supra* note 326, at 209, 285–86 (posing several questions which may arise from borrowing and lending in cryptocurrencies).

[332] *Id.* at 209, 285 (2019) (considering the issues and risks associated with lenders of last resorts with access to unlimited sources of liquidity, such as exposure limits and interbank exposure).

[333] VIRTUAL CURRENCY SCHEMES, *supra* note 28, at 38–40 (commenting on the use of fractional reserve banking in extending credit); *see also* Nabilou, *supra* note 326, at 209, 286 (mentioning the potential direct and indirect exposure to liquidity problems as a result of fractional reserve banking).

[334] Carlos Garcia-de-Andoain et al., *Lending-of-Last-Resort Is As Lending-of-Last-Resort Does: Central Bank Liquidity Provision and Interbank Market Functioning in the Euro Area* 9–10 (Eur. Cent. Bank Working Paper Series No 1886, 2016), https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1886.en.pdf (summarizing the functions of central banks in terms of deposit facilities and marginal lending). This is made redundant by the introduction of fixed rate full allotment policy (FRFA). *Id.* at 10 ("While still in place, the ECB marginal lending facility—the equivalent of the Fed's discount window was made redundant by the FRFA policy: since banks could borrow unlimited amounts of liquidity at the weekly refinancing operations, the use of the marginal lending facility was extremely limited thereafter.").

[335] *See id.* at 4, 9–10 ("[By] providing unlimited liquidity against good collateral, … the ECB acted as a de facto LOLR for the whole banking system of the euro area.").

[336] *See generally*, Connor Blenkinsop, *How Supply Affects Crypto's Value, Explained*, COIN TELEGRAPH (Mar. 05, 2019), https://cointelegraph.com/explained/how-supply-affects-cryptos-value-explained [https://perma.cc/L2JV-G53W] ("The world's biggest cryptocurrency, Bitcoin, has a fixed supply of 21 million. …"); Phillip Nunn, *The Bitcoin Supply Curve*, MEDIUM (Jan.

such as Basis,[337] are being structured on the algorithmic central banking model, which provides for price stability using flexibility in money supply, it is unlikely that stablecoin experiments would succeed in the presence of credible central banks with long-established reputations for price stability.

The third scenario, in which banks would be involved in cryptocurrency businesses, is that banks themselves would engage in issuing such currencies either for retail payment services or for wholesale payments.[338] Whether it is prudentially acceptable for banks or a consortium of banks to be allowed to issue their own retail-oriented cryptocurrencies or use settlement tokens in clearing and settling obligations remains an open question.[339] Potential liquidity and legal challenges that this type of money creation and particularly its use in

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11, 2019) https://medium.com/@PhillipNunn/the-bitcoin-supply-curve-513554e6588d [https://perma.cc/UD6U-7HXL] ("Without getting overly technical, the algorithmic schedule of mining is predetermined, public, and final—the last bitcoin will be mined in 2140.").

[337] *Home*, BASIS, https://www.basis.io/ [perma.cc/Y44V-UUPK] (outlining the goals of the "stable, decentralized cryptocurrency called Basis" in order to "creating a better monetary system."). *See id.* ("Basis is designed to keep prices stable by algorithmically adjusting supply … we refer to Basis as having an algorithmic central bank."). This project was shut down in December 2018, perhaps due to its shaky economic foundations. *See id.* (blaming the company's delays on U.S. securities regulation in hindering their ability to launch a "better monetary system."). *Cf.* Jemima Kelly, *The John Taylor-Backed "Stablecoin" That's Backed by, Um, Stability*, FIN. TIMES (June 25, 2018) (speaking generally to stablecoins emergence and their qualities). *See also* Schär & Berentsen, *supra* note 156, at 69 ("The most prominent algorithmic stablecoin is called Basis … but the project was recently closed and what is left of the funding will be returned to the investors.").

[338] *See generally* COMMITTEE ON PAYMENTS AND MARKET INFRASTRUCTURES & MARKETS COMMITTEE, CENTRAL BANK DIGITAL CURRENCIES, BANK FOR INTERNATIONAL SETTLEMENTS 15–17 (Mar. 2018), https://www.bis.org/cpmi/publ/d174.pdf [https://perma.cc/4JLX-8BX2] [hereinafter CENTRAL BANK DIGITAL CURRENCIES] (extrapolating on the issuance of central bank digital currencies by banks and their effects on business models, financial intermediation and markets, and financial stability).

[339] *See id.* at 1–2, 7–10, 14–18 (expanding on the potential implication of a central bank introducing their own digital currency or clearing and settlement systems).

privately organized clearing and settlement systems would not rally in favor of such developments.[340]

The fourth scenario would be for banks to offer cryptocurrency accounts or custodian wallets, to establish proprietary trading desks in cryptocurrencies, or eventually to offer cryptocurrency funds, including Exchange Traded Funds (ETFs), or cryptocurrency derivative products.[341] However, given the liquidity risks in the cryptocurrency business and its derivatives, regulators, including the ECB, either in their supervisory role or as a catalyst for change, may consider banning banks from trading in cryptocurrencies.[342] Such a strategy may be implemented through the competent authorities of the Member States through the mechanism offered by article 104 of the Capital Requirements Directive IV (CRD IV), empowering competent authorities "to restrict or limit the business, operations or network of institutions or to request the divestment of activities that pose excessive risks to the soundness of the institution," or "to require the reduction of the risk inherent in the activities" or to impose additional capital and liquidity requirements.[343] In addition, the ECB can make use of its supervisory powers within the framework of its comprehensive assessment (asset quality review (AQR) and stress testing) and establish a stricter framework for assessing credit institutions' exposure to crypto-

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[340] *See id.* at 7–10 (discussing the potential risks to liquidity and legal barriers to implementing central bank digital currencies); *see also id.* at 7–10 (discussing the potential risks to liquidity and legal barriers to implementing central bank digital currencies).

[341] *See* VIRTUAL CURRENCY SCHEMES, *supra* note 28, at 39 (proffering the potential use of banks as a digital wallet for cryptocurrencies); Nathaniel Popper, *Goldman Sachs to Open a Bitcoin Trading Operation*, N.Y. TIMES, (May 2, 2018), https://www.nytimes.com/2018/05/02/technology/bitcoin-goldman-sachs.html (providing an example of banks venturing into cryptocurrency offerings).

[342] ECB Crypto-Assets Task Force, *supra* note 172, at 7–9, 28–30 (analyzing the effects of crypto-assets, including digital currencies and derivatives, and the regulatory action and issues nations and the ECB have or could potentially take or experience).

[343] *See* Directive 2013/36, of the European Parliament and of the Council of 26 June 2013 on Access to the Activity of Credit Institutions and the Prudential Supervision of Credit Institutions and Investment Firms, art. 4, 2013 O.J. (L 176) 393–436 (EU). *See generally* EUROPEAN BANKING AUTHORITY, REPORT WITH ADVICE FOR THE EUROPEAN COMMISSION ON CRYPTO-ASSETS (2019).

currencies.[344] Alternatively, regulators may consider imposing structural regulation,[345] such as ring-fencing of proprietary trading in cryptocurrencies from other activities of banks, or imposing subsidiarization requirements for activities related to cryptocurrencies to avoid cross-subsidization of cryptocurrency proprietary trading by the governments' implicit and explicit subsidies to banks.[346]

VI. Cryptocurrencies and Financial Stability

At the time of this writing, there is a lack of reliable empirical evidence on the impact of cryptocurrencies on the banking system and financial stability.[347] In addition to the lack of data, the existing data may be manipulated by market-manipulating activities such as "wash trading, spoofing, and pump and dump" strategies.[348] Despite all the

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[344] EUROPEAN CENTRAL BANK, PRESS RELEASE: ECB STARTS COMPREHENSIVE ASSESSMENT IN ADVANCE OF SUPERVISORY ROLE (2013), [https://perma.cc/RAL2-BGGB] (describing the ECB's ability to assess banks using a number of methodologies including asset quality reviews and stress tests).

[345] For payment institutions, such structural regulation would be imposed using the powers granted under article 11(5) PSD2. *See* Directive 2015/2366, of the European Parliament and of the Council of 25 November 2015 on Payment Services in the Internal Market, art. 11, 2015 O.J. (L 337) 67.

[346] *See* Hossein Nabilou, *Bank Proprietary Trading and Investment in Private Funds: Is the Volcker Rule a Panacea or Yet Another Maginot Line?*, 32 BANKING & FIN. L. REV. 297, 331 (2017) (examining one method of limiting cross-subsidation of cryptocurrency proprietary trading through the Volcker Rule). For a discussion on the implicit government subsidies to banks, *see* ANAT R. ADMATI & MARTIN HELLWIG, THE BANKERS' NEW CLOTHES: WHAT'S WRONG WITH BANKING AND WHAT TO DO ABOUT IT 137–138 (2013); *see generally* DOUGLAS J. ELLIOT, THE BROOKINGS INSTITUTE, IMPLICIT SUBSIDIES FOR VERY LARGE BANKS: A PRIMER (2014). The potential widespread use of cryptocurrencies in the financial system would raise additional questions about the margins (initial and variation margins) that could be set on cryptocurrency trading and their derivatives and whether there should be special regulatory capital, leverage, and liquidity requirements for the exposure to cryptocurrencies.

[347] MEGAN MCBRIDE & ZACK GOLD, CNA ANALYSIS & SOLUTIONS, CRYPTOCURRENCY: IMPLICATIONS FOR SPECIAL OPERATIONS FORCES 49 (2019) ("US government expertise on cryptocurrencies is limited to some very small pockets.").

[348] FIN. STABILITY BD., CRYPTO-ASSETS: REPORT TO THE G20 ON THE WORK OF THE FSB AND STANDARD-SETTING BODIES (2018) [hereinafter FSB REPORT TO THE G20].

above questions and hypothetical scenarios, the available data suggest that the market capitalization, leverage, and interconnectedness in the cryptoasset markets are unlikely to destabilize banking system and financial markets, or negatively affect the real economy.[349] The correlation in the price of cryptoassets may suggest that there might be a risk of herd behavior in cryptocurrency markets.[350] However, even in the presence of herd behavior, the small size of the industry would not imply that such price movements would cause systemic risk.[351]

Indeed, the passive approach to regulating cryptocurrency markets heretofore can also be attributable to their insignificant size relative to conventional financial markets.[352] At its peak, cryptocurrency market capitalization reached around $800bn.[353] This figure pales in comparison to the total assets of the Monetary Financial Institutions (MFIs) in the euro area which in March 2017 stood at around €34tr.[354] The total market capitalization of the overall cryptocurrencies at its peak was smaller than the market capitalization of the largest NASDAQ listed company (i.e., Apple Inc.) with a market capitalization of $1.08tr as of September 11, 2018.[355] At the same time, the market capitalization of bitcoin, the largest and the most popular cryptocurrency was around

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[349] *Id.* at 6 ("At present, like crypto-assets in general, crypto-asset platforms do not pose global financial stability risks.").

[350] *See,* Paulo Vitor Jordãode Gama Silva et al., *Herding Behavior and Contagion in the Cryptocurrency Market*, 22 J. BEHAV. & EXPERIMENTAL FIN. 31 (2019) (discussing the increase in herding in the cryptocurrency market).

[351] *See* Angela Walch, *Islands No More: Crypto Hedge Funds Bring Cryptocurrency Risk into Mainstream Financial System*, FORBES (Oct. 11, 2017, 11:33 PM), https://www.forbes.com/sites/angelawalch/2017/10/11/islands-no-more-crypto-hedge-funds-bring-cryptocurrency-risk-into-mainstream-financial-system/#70a0e3685281 [https://perma.cc/66P8-W93R].

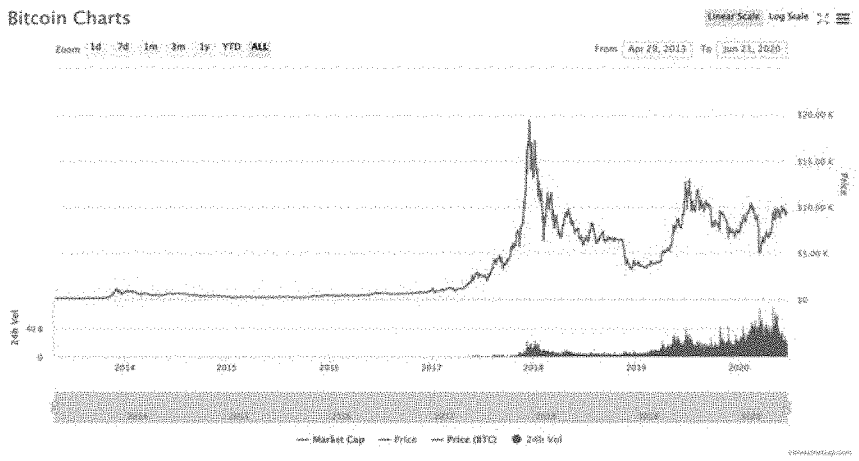
[352] *See* Omri Marian, *A Conceptual Framework for the Regulation of Cryptocurrencies,* 82 U. CHI. L. REV. DIALOGUE 53, 63–64 (2015) (stating "legitimate users passively participate in regulatory efforts to prevent illicit behavior").

[353] *See* Andre Marshall, *Combined Crypto Market Capitalization Races Past $800 Bln*, COINTELEGRAPH (Jan. 7, 2018) https://cointelegraph.com/news/combined-crypto-market-capitalization-races-past-800-bln [https://perma.cc/W34X-NBY8].

[354] EUROPEAN CENTRAL BANK, REPORT ON FINANCIAL STRUCTURES 4 (2017).

[355] *See* Apple Market Cap 2006–2019 | AAPL, MACROTRENDS, https://www.macrotrends.net/stocks/charts/AAPL/apple/market-cap [https://perma.cc/DP2F-9F2D].

$110bn and the total market capitalisation of all cryptocurrencies stood at around $189bn.[356]



Bitcoin price as of June 21, 2020

Therefore, even the collapse of the overall cryptocurrency market is unlikely to give rise to any financial stability concerns.[357] In addition to its insignificant size, the limitations on the ECB's powers would constrain its role in financial stability even in the presence of systemic risks of cryptocurrency markets.[358]

Despite the fact that the possibility of a systemic impact in the future cannot be ruled out,[359] this Article will not consider systemic externality as a ground for regulatory intervention in the cryptoasset

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[356] *See Top 100 Cryptocurrencies by Market* Capitalization, https://coinmarketcap.com (last visited May, 22, 2020).

[357] *See* MARK CARNEY, CHAIR OF FINANCIAL STABILITY BOARD, LETTER TO G20 FINANCIAL MINISTERS AND CENTRAL BANK GOVERNORS (2018) (staing "crypto-assets do not pose risks to global financial stability at this time"); (confirming that crypto-assets currently do not pose systemic risks).

[358] *See* Samburaj Das, *Cryptocurrency Impact 'Limited' to Pose Any Threat Yet: ECB Chief,* CCN (Nov. 22, 2017), http://www.ccn.com/cryptocurrency-impact-limited-pose-threat-yet-ecb-chief/ [https://perma.cc/T7EU-Y6N7] (stating that the chief of the ECB admitted "it's not within our powers to prohibit or do something of the nature … or to regular bitcoin").

[359] FIN. STABILITY BD., CRYPTO-ASSET MARKETS: POTENTIAL CHANNELS FOR FUTURE FINANCIAL STABILITY IMPLICATIONS, at 11 ("[L]arge market capitalisation of crypto-assets and easy convertibility with fiat currencies could entail new risks to the financial system . …") (2018).

markets.[360] The reason is twofold. In addition to the lack of reliable data, which is explained above, the ECB has a limited role in maintaining financial stability.[361]

The ECB is a single-mandate central bank with price stability being central to its tasks.[362] With respect to the contribution of the ECB to financial stability, the TFEU uses a rather nuanced wording. Article 127(5) of the TFEU explicitly mentions that "[t]he ESCB shall *contribute* to the smooth conduct of policies *pursued by the competent authorities* relating to the prudential supervision of credit institutions and the stability of the financial system."[363] Although "[p]rice stability and financial stability are tightly interconnected and mutually reinforcing,"[364] financial stability is neither among the objectives of the ECB according to the first paragraph of the Art. 127, nor is it among its four basic tasks. Accordingly, the ECB lacks appropriate regulatory, supervisory or operational tools in the area of financial stability.[365] This means that even if cryptocurrencies posed systemic risk to the financial system, the ECB would not have sufficient tools to address such risk.[366] With respect to financial stability, the ECB has only a "contri-

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[360] This also does not mean that small economies would be immune to the risks of cryptocurrencies. *See, e.g.*, Conor Sen, *Crytocurrencies Are Starting to Affect the Real Economy*, BLOOMBERG (Dec. 18, 2017, 1:37 PM) (observing real economy susceptible to risk of crypto-bust) https://www.bloomberg.com/opinion/articles/2017-12-18/cryptocurrencies-are-starting-to-affect-the-real-economy [https://perma.cc/5PAU-6AUX].

[361] FSB REPORT TO THE G20, *supra* note 351, at 7 ("One challenge encountered in the existing analyses related to crypto-assets is the scarcity of reliable data on banks' holdings of crypto-assets.")

[362] TFEU Art. 127(1) ("The primary objective of the European System of Central Banks … shall be to maintain price stability.")

[363] TFEU Art. 127(5).

[364] Peter Praet, The Interaction Between Monetary Policy and Macroprudential Policy, Speech at the Money, Macro and Fin. Research Group Conference on the Resilience of the Global Fin. Architecture (Sept. 27, 2018) (transcript available at https://www.bis.org/review/r181004b.pdf);) *see also* Markus K. Brunnermeier & Yuliy Sannikov, *A Macroeconomic Model with a Financial Sector*, 104 AM. ECON. REV. 379 (2014) (observing how financial frictions lead to the amplification of shocks through prices).

[365] Yves Mersch, Member of the Executive Board of the ECB, Financial Stability and the ECB, Speech at ESCB Legal Conference, at 3 (Sept. 6, 2018) ("[T]he ECB has *neither exclusive powers* in the field of financial stability nor competence to act on its own.").

[366] Accordingly, financial stability is not the exclusive competence of a single institution. The task of preserving financial stability has been spread out

butory and supporting role,"[367] which is different from the shared competence and has the narrowest scope. Accordingly, in the euro area, the primary responsibility of maintaining financial stability remains with the national competent authorities.[368]

However, it is likely that financial stability concerns may eventually materialize through the banking or payment systems, and, in this regard, the prudential supervisory powers of the ECB on credit institutions can play an important role in mitigating such risks.[369] The supervisory competence of the ECB is limited to the *prudential* supervision of credit institutions within the Single Supervisory Mechanism (SSM), the details of which are laid out in the SSM regulation[370] the

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among national, supranational and international actors such as finance ministries, supervisory expert bodies, (such as the European Systemic Risk Board (ESRB) and other national macroprudential regulators) central banks and the FSB. *See* Praet, *supra* note 367, at 4 (discussing effects of ECB's monetary policy on the financial system). For example, ESMA "may temporarily prohibit or restrict certain financial activities that threaten the orderly functioning and integrity of financial markets or the stability of the whole or part of the financial system in the Union". *See* European Parliament and of the Council No. 1095/2010 of 24 Nov. 2010, art. 9(5) 2010 O.J. (L 331); *see also* Regulation (EU) No 236/2012, art. 28 (discussing short-selling regulation); Regulation (EU) No 600/2014, art. 40 (discussing rules regarding access to CCPs). *See also* Asen Lefterov, *The Single Rulebook: Legal Issues and Relevance in the SSM Context*, at 27 (discussing ESAs' role in enhancing supervisory convergence).

[367] For the limitations on the scope of supervision of credit institutions by the ECB, *see* Mersch, *supra* note 369, at 4 ("[T]he contributory role of the ECB needs to support its monetry policy taks or the tasks conferred upon it relating to the prudential supervision of credit institutions and other financial institutions."); *see also* Article 28 of Regulation (EU) No 236/2012 (discussing short selling regulation); Article 40 of Regulation (EU) No 600/2014 (discussing MiFIR). This limitation is spelled out in Article 1, sixth subparagraph, and Article 4(3) of Regulation (EU) No 1024/2013, *supra* note 62. There is also a very limited scope for the ECB in regulation. *See id.*, at 38.

[368] *See* Mersch, *supra* note 368, at 1 (discussing how ECB's primary purpose is to ensure price stability).

[369] *See, e.g.*, ECB Crypto-Assets Task Force, *supra* note 172 (analyzing recent developments in crypto-asset markets and their impact on financial stability and financial markets).

[370] Council Regulation 1024/2013, 2013 O.J. (L287) 63-89 (EU) (describing the Single Supervisory Mechanism).

SSM framework regulation,[371] the EBA regulation[372] and the ECB's Guide to Banking Supervision; the detailed treatment of this would go beyond this article.[373] As the scaling solutions for cryptocurrencies are being developed, it seems that the majority of the activities within the cryptocurrency ecosystem would migrate to second layers, and the protocol level would only be used for secure (deferred) net settlements.[374] As participants in the second layers would likely be banks, payment institutions, and other financial institutions, the powers of the ECB in the supervision of credit institutions and payment systems will be of utmost importance.[375] Thus, given the possibility of such developments—and due to the limitations on the ECB's mandate—the ECB

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[371] Council Regulation 468/2014, 2014 O.J. (L141) 1-50 (EU) (underlining role of EBA and relationship with ECB).

[372] Council Regulation 1022/2013, 2013 O.J. (L287) 5-14 (EU) (amending Council Regulation 1093/2010 to establish a European Supervisory Authority (European Banking Authority) as regards the conferral of specific tasks on the European Central Bank pursuant to Council Regulation 1024/2013).

[373] *See generally* EUROPEAN CENTRAL BANK, GUIDE TO BANKING SUPERVISION (Nov. 2014) https://www.bankingsupervision.europa.eu/ecb/pub/pdf/ssmguidebankingsupervision201411.en.pdf [https://perma.cc/R7VU-WJR3]. Under the SSM regulation and relevant framework regulation, the ECB assumes the direct supervision of the largest banks and those banks that received state support, amounting to approximately 85% Eurozone banking assets. The smaller banks fall under the direct supervision of the National Competent Authorities (NCAs) as part of the SSM and following the ECB instructions. This is in essence an indirect supervision of smaller banks by the ECB. The ECB can always step in and directly supervise such banks. With respect to prudential regulation, ECB has defined supervisory powers of micro and macroprudential nature. Microprudential measures that the ECB can take include authorization and withdrawal of license, authorizing acquisition or disposal of significant holdings, regular prudential tools, such as governance, remuneration standards and imposing limitations to businesses or even divestments, conducting stress tests, and supervising capital, leverage and liquidity requirements mainly embedded in the Capital Requirements Directive IV (CRD IV) and Capital Requirements Regulation (CRR). *See* Council Directive 2013/36, 2013 O.J. (L176) 338-436 (EU) (describing "prudential supervision of credit institutions and investment firms"); *see also* Council Regulation 575/2013, 2013 O.J. (L176) 1-337 (EU) (amending "prudential requirements for credit institutions and investment firms").

[374] Hossein Nabilou, *supra* note 202, at 288.

[375] *See* Bloomberg, *supra* note 165 (explaining how Bitcoin can be used to circumvent capital controls).

can best intervene indirectly in the cryptocurrency markets if systemic risk were to stem from cryptocurrency markets.[376]

VII. Indirect Technical Intervention

Remittance business, which is one of the most prominent use-cases of cryptocurrencies, owes its existence to both the frictions in payment systems across national jurisdictions and to the lack of global currency.[377] As mentioned above, one of the strategies that could be deployed by central banks is technical intervention in cryptocurrency markets.[378] In this section, we explore the venues for indirect technical intervention in the cryptocurrency markets by the ECB, which could be achieved not by regulating the existing cryptocurrencies, but by issuing its own cryptocurrencies. This would be an indirect intervention because it only affects cryptocurrencies by providing an alternative virtual currency that exerts a competitive force on cryptocurrencies by leveraging on its price stability.

However, there are various ways of indirectly influencing cryptocurrencies before issuing CBDC. In this regard, to pick up the lowest hanging fruit, central banks may consider ameliorating the existing payment infrastructures. Such initiatives may focus on coordination and collaboration with other central banks within the international financial fora to enhance the interoperability of payment systems operated by central banks, or they may focus on encouraging banking and payment associations to make efforts to enhance the efficiency of their infrastructure for cross-border fund transfers.[379] One of the main venues through which the ECB can achieve such objectives is though

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[376] *Id.* (implying that the ECB might be given the power to hold and interve in cryptocurrencies).

[377] Jared Cotton, *Sending a Bit More Coin Home? An Analysis of Retail User Protection in Bitcoin Remittance Markets*, 49 VICTORIA U. WELLINGTON L. REV. 107, 109 (2018) ("Remittances play a key humanitarian role in providing stable income in what can be an unstable financial environment.").

[378] *See supra* Part 3 ("[O]r they would be aimed at venturing into the uncharted territory of issuing CBDC's, to which we will return in the final part of the paper.").

[379] For the public-private nature of payments law, *see generally* Agnieszka Janczuk-Gorywoda, *Evolution of EU Retail Payments Law* (Tilburg L. Sch. Legal Studies Research Paper Series, No. 21/2015, 2015) (emphasizing the fact that the private initiative has often been insufficient in pushing for improvements of efficiency in the payment system and public or government intervention (in the case in question, SEPA regulation) is often needed).

improving the current payment systems in which the ECB may act in its role as a catalyst for change. For example, the SEPA Instant Credit Transfer (SCT-Inst), which was launched in 2017 enabled instant euro payments across Europe around the clock, 365 days per year.[380]

Another main improvement to the current payment infrastructure is the TARGET Instant Payment Settlement (TIPS)—launched in 2018—that provides for a real-time settlement in CeBM.[381] By making its infrastructure available to banks and payment institutions, the ECB, in collaboration with its international counterparts, can encourage banks and payment institutions to enhance efficiency and lower their fees for cross-border payments.

Further improvements can be made in respect to the options that are available for online payments. In this regard, encouraging an increase in the spectrum of the digital payment instruments that encompasses wider features of efficiency, anonymity, and security would be a policy option. Providing such wider choices to users would provide alternatives to using cryptocurrencies and may in the long run result in the mitigation of cryptocurrencies' impact on the payment system. A wide variety of payment solutions are already offered by various payment instruments such as cash, debit and credit cards, electronic fund transfers or wire transfers, online payment platforms, and e-money. However, two main shortcomings of the existing digital payments are in privacy and, to a lesser extent, security. This is in spite of the fact that the existing prepaid payment cards offer certain levels of privacy.[382] Additional improvements in the existing payment system can be achieved by efforts to further reduce the amount of cross-subsidization of card users by cash users.[383] Although the Multilateral Inter-

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[380] This development can only be indirectly associated with the ECB. The Euro Retail Payments Board (ERPB) which is chaired by the ECB, requested an action plan from the European Payments Council (EPC) who eventually launched the SCT-Inst. *See* SEPA Instant Credit Transfer, European Payments Council, https://www.europeanpaymentscouncil.eu/what-we-do/sepa-instant-credit-transfer (last visited Mar. 5, 2020).

[381] Eur. Cent. Bank, *What are Instant Payments?*, (last visited Nov. 5, 2019) https://www.ecb.europa.eu/paym/integration/retail/instant_payments/html/index.en.html [perma.cc/5BPS-XHXM].

[382] Courtney J. Linn, *Regulating the Cross-Border Movement of Prepaid Cards*, 11 J. MONEY LAUNDERING CONTROL, 146, 147 (2008) ("Another attraction is the relative degree of anonymity a prepaid card affords the person who acquires it and uses it.").

[383] As merchant costs might be higher for card payments, especially those offering a reward, to compensate those costs, merchants increase the general

change Fee (MIF) Regulation partly decreases the amount of interchange fee, it does not eliminate it altogether.[384]

It is worth mentioning that the considerations of efficiency have not been the main driver of cryptocurrency use. In contrast, one of the main motivations of the emergence of cryptocurrencies has been the censorship of payments in the existing payment infrastructures.[385] Although the censorship resistance property of some cryptocurrencies would not be welcome under accountable governments, it is a useful feature for that portion of the population who live under less accountable governments. Under such regimes, a censorship resistance feature can be a tool for empowering the users by furnishing them with a global un-censorable digital store of value and medium of exchange, which is totally independent from the whims of the unaccountable political system.

A. Issuing CBDC

In addition to the above-mentioned incremental changes that the ECB can effect or catalyze, the main innovative and radical non-regulatory action that it can take as a strategy to provide alternatives to the growth of privately issued cryptocurrencies is the issuance of CBDC or DBM.[386] This could offer a stable virtual currency to users

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level of prices for all the customers, which eventually leads to cross-subsidization of credit card users by cash, check, or debit cards users. *See* Benjamin Klein et al., *Competition in Two-Sided Markets: The Antitrust Economics of Payment Card Interchange Fees*, 73 ANTITRUST L.J. 571, 615 (2006).

[384] European Commission Press Release [Memo]/16/2162, Antitrust: Regulation on Interchange Fees (June 9, 2016) (explaining interchange fees); *see also* Banking and Payment systems, European Commission, https://ec.europa.eu/competition/sectors/financial_services/enforcement_en.html (last visited Mar. 21, 2020) (describing Visa's and Mastercard's decisions with interchange fees).

[385] *See generally* NAKAMOTO, *supra* note 3 (describing benefits of Bitcoin).

[386] For a definition of CBDC and its unique features as compared to banknotes and CeBM, *see* DIGITAL INNOVATION IN FINANCIAL SERVICES, *supra* note 95 (discussing central banks reflecting on the issuance of CBDC as a resposne to the advent of DLTs). CBDC would be different from e-money. One of the first central banks contemplating to issue CBDC is the Sveriges Riksbank. *See* SVERIGES RIKSBANK, THE RIKSBANK'S E-KRONA PROJECT REPORT 13 (Sept. 2017) ("[I]n mid-March, we launched a project with the aim of investigating the need for a so-called e-krona and the possible consequences of introducing such a complement"); RIKSBANK REPORT 2, *supra* 96, at 1–3 (mentioning that

and could function as a unit of account in cryptocurrency markets, the lack of which currently poses one of the most challenging issues that cryptocurrency markets face.[387] The mounting interest in creating stablecoins in the cryptocurrency industry in 2018 showed the importance of price stability for an effective digital medium of exchange.[388] However, most of these attempts were limited to using collateralization techniques to create safety and stability giving birth to stablecoins that are either collateralized by fiat money or by cryptocurrencies.[389] Prior financial crises, and in particular runs on repos during such crises, have demonstrated that such techniques can hardly bring long-term safety and stability.[390] In the case of cryptocurrencies based on algorithmic central banking, it is hard to imagine their success in the absence of a long-established reputation of price stability.[391] This might prove to be a window of opportunity for central banks to leverage their existing credibility to create stable CBDC.[392] However,

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the idea of issuing CBDC's is a new one that is relatively unexplored, and that Sweden will continue to investigate if, when, and how to implement such currency).

[387] DIGITAL INNOVATION IN FINANCIAL SERVICES, *supra* note 95 (including the provision of a stable virtual currency to the public as a major benefit of CBDC).

[388] Barry Eichengreen, *Why 'Stable Coins' Are NO Answer to Bitcoin's Instability*, THE GUARDIAN (Sept. 11, 2018), https://www.theguardian.com/technology/2018/sep/11/stable-coins-bitcoin-cryptocurrencies-tether (comparing Bitcoin unfavorably to "viable monies" because of the stability of the latter and wildly fluctuating value of the former).

[389] Matthew Leising & Olga Kharif, *Why Facebook Chose Stablecoins as Its Path to Crypto*, WASH. POST (June 18, 2019), https://www.washingtonpost.com/business/why-facebook-chose-stablecoins-as-its-path-to-crypto/2019/06/18/2fa7d738-91e7-11e9-956a-88c291ab5c38_story.html ("Collateralized stablecoins are pegged to another asset, like the U.S. dollar, a basket of national currencies or commodities … [o]ther stablecoins are pegged to the price of crypto assets like ether or a group of digital currencies.").

[390] *See* Manuel A. Utset, *Rational Financial Meltdowns*, 10 HASTINGS BUS. L.J. 407, 433–37 (2014) (explaining bank runs and the shortcomings that led repo markets to contract quickly in 2007 and 2008).

[391] DIRK BULLMAN ET AL., IN SEARCH FOR STABILITY IN CRYPTO-ASSETS: ARE STABLECOINS THE SOLUTION? (European Central Bank, Aug. 2019) (discussing the value of central banks in creating the financial stability sought to be mirrored by stablecoins).

[392] Alastair Marsh, *Why Central Bankers Got Serious About Digital Cash*, WASH. POST (Oct. 21, 2019), https://www.washingtonpost.com/business/why-central-bankers-got-serious-about-digital-cash/2019/10/20/55f7d3da-f307-

as it will be explained, issuing CBDC would potentially face practical and legal challenges, and undermine efforts to maintain financial stability.

Although the power to issue banknotes and coins is the sole prerogative of governments, it may not necessarily include the power to issue CBDC, because issuing CBDC does not seems to be merely an inconsequential technological upgrade to the old-age technology of issuing money.[393] As the CBDC would be programmable money, its nature would be different from that of the physical banknotes and coins.[394] This property of CBDC means that it can accommodate features that can potentially amount to granting additional powers to central banks, such as having higher surveillance power over transactions and imposing negative interest rates, that would otherwise be absent or limited.[395] Therefore, from a public law perspective, issuing CBDC by the ECB would face legal hurdles.[396]

Moreover, from technical and economic perspectives, issuing CBDC has proved to be controversial as it carries many risks alongside its potential benefits.[397] Despite the perceived benefits of issuing

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11e9-bb7e-d2026ee0c199_story.html (discussing the considerations central banks are making in deciding whether to issue CBDC).

[393] CENTRAL BANK DIGITAL CURRENCIES, *supra* note 341, at 9–10 ("Not all central banks have the authority to issue digital currencies and expand account access, and issuance may require legislative changes, which might not be feasible, at least in the short term.").

[394] Todd Keister & Daniel Sanches, Should Central Banks Issue Digital Currency? (Fed. Reserve Bank of Phila., Working Paper No. 19-26, 2019), https://philadelphiafed.org/-/media/research-and-data/publications/working-papers/2019/wp19-26.pdf [perma.cc/4BGE-CGNW ("Within this framework, we interpret a central bank digital currency as a new, technologically distinct type of outside money.").

[395] CENTRAL BANK DIGITAL CURRENCIES, *supra* note 341, at 2, 9 (arguing that a benefit of CBDC would be central banks' increased ability to counteract money laundering and financial terrorism).

[396] *Id.* at 9–10 (explaining the varied legal challenges to issuing CBDC, depending on the legal charters and abilities of various central banks).

[397] For an overview of the pros and cons, various design features, as well as macroeconomic impact of issuing CBDC, *see generally* Barrdear & Kumhof, *supra* note 32 (explaining potential macroeconomic consequences of widespread CBDC issuance); DIGITAL INNOVATION IN FINANCIAL SERVICES, *supra* note 95, at 181–213 (providing an overview of the pros and cons of issuing CBDC); *see also* Bordo & Levin, *supra* note 2; Raskin & Yermack, *supra* note 96 (providing an overview of the debates over the wisdom of prospective CBDC-issuance policies).

CBDC in terms of price stability, the smooth operation of payment systems and the conduct of monetary policy—e.g. removing the zero lower bound (ZLB) constraint on monetary policy operations—the decision to issue CBDC should be made taking a full account of a set of broader policy objectives, including technical (safety and efficiency considerations), economic and legal considerations such as technological neutrality, and the users' freedom of choice of means of payments.[398] Therefore, in addition to the objectives of price stability, the impact of issuing CBDC on the implementation of monetary policy and the smooth operation of the payment system, its impact on banking and financial stability (e.g., encouraging bank runs), and its impact on the efficient and decentralized allocation of credit should be carefully studied.[399]

Here, we only study the CBDC from a legal perspective and analyze if the ECB has the power to issue such cryptocurrencies. For example, art. 127 TFEU states that "[t]he ESCB shall act in accordance with the principle of an open market economy with free competition, favouring an efficient allocation of resources, and in compliance with the principles set out in Article 119."[400] Issuing CBDC would be in contradiction with this provision if it were to lead to a centralized allocation of credit by central banks.[401] Therefore, before engaging in issuing such digital currencies, it is prudent to examine if the TFEU or

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[398] *See generally* Mersch, *supra* note 21 (arguing for a high-level view and consideration of broad policy objectives when evaluating the options for transition to CBDC).

[399] It seems that at the moment most central banks are not convinced that the benefits of issuing CBDC would outweigh the costs. *See* Christian Barontini & Henry Holden, *Proceeding with Caution—Survey of Central Bank Digital cCurrency* (Bank for Int'l Settlements, Working Paper No. 101, 2019) (discussing specific potential externalities of CBDC issuance that should be studied in depth before central banks make such a move).

[400] Consolidated Version of the Treaty on the Functioning of the European Union art. 127, Oct. 26, 2012, 2012 O.J. (C 326) 47; Council Regulation 326/230, On the Statute of the European System of Central Banks and of the European Central Bank art. 2, 2012 O.J. (C 326) 230.

[401] *Id.*; *see also* Hossein Nabilou, *Central Bank Digital Currencies: Preliminary Legal Observations*, OXFORD BUS. L. BLOG (Feb. 22, 2019), https://www.law.ox.ac.uk/business-law-blog/blog/2019/02/central-bank-digital-currencies-preliminary-legal-observations [perma.cc/76BD-4D5A] ("This would be detrimental to efficient allocation of credit in the economy and would undermine 'the principle of an open market economy with free competition,' in accordance to which the ECB should act.").

the ESCB/ECB Statute and other monetary laws of the EU grant such powers to the ECB and how issuing such currencies might come into conflict with the basic tenets and principles enshrined in the EU primary and secondary laws.[402] In what follows, we briefly touch upon the various hypothetical design features of CBDC and then will have an overview of its impact on banking and financial stability, on the efficient allocation of credit, and its implications for the future of central banking in terms of its accountability and independence.

B. Design Features of CBDC

Based on the specific design features that a given CBDC may take, it can trigger different legal questions. This is mainly based on whether a given CBDC will be account-based or value-based,[403] or whether it will be retail or wholesale.[404] As to the account-based CBDC, the third parties would hold accounts in the issuing central bank in which the CBDC would be booked and transacted.[405] Accordingly, the transfer of the CBDC and its finality would be ensured by

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[402] Eventually, this analysis will be a consequentialist one and will be heavily dependent on the cost-benefit analysis of issuing CBCD. In turn, the cost-benefit analysis of CBDC depends on its design features of CBDC. *See, e.g.*, NORGES BANK, *No. 1: Central Bank Digital Currencies*, NORGES BANK PAPERS 5 (2018) (stating that whether Noway issues a CBDC depends on the design of that CBDC).

[403] Yves Mersch, Member of the Executive Board of the European Central Bank, Digital Base Money: An Assessment from the European Central Bank's Perspective, Speech at the Farewell ceremony for Mr. Pentti Hakkarainen, Deputy Governor of the Bank of Finland (Jan. 16, 2017) (distinguishing between account-based and value-based CBDC).

[404] Vitas Vasiliauskas, Chairman of the Board, Bank of Lithuania, Speech at the Reinventing Bretton Woods Committee Conference: Central Bank Digital Currencies (Apr. 12, 2019) (distinguishing between wholesale and retail currencies).

[405] DIGITAL INNOVATION IN FINANCIAL SERVICES, *supra* note 95, at 187 ("A particular example of CBDC would be *account-based* if its issuing central bank were to book it in accounts that third parties would hold with it, as issuing central bank, and if the latter were to also centralise, in its books, the process of its transfer (meaning that legal finality of payments in CBDC would be achieved *centrally*, at the instance of the issuing central bank, which would thus assume responsibility for providing payments to payors and payees).")

the issuing central bank on the book-entry basis.[406] In this sense, account-based CBDC will not be significantly different from the reserve balances of the issuing central bank, with the sole difference that in addition to commercial banks and certain other entities, natural and legal persons would be able to hold accounts with the issuing central bank.[407] In contrast, the value-based CBDC is likely to take the form of digitally stored units or tokens in the holders' wallets whose transfer and finality would occur in a P2P fashion.[408] This form of CBDC would be very similar to cash and it could possibly provide anonymity to users even with regard to central banks.[409] Other idiosyncrasies in the design features of CBDC would include issues such as whether the CBDC would be intended to substitute or complement cash and bank deposits, whether the CBDC holders would constitute legal or natural persons or both, and whether such currencies afford users with anonymity, at-par convertibility, and interest accrual features.[410]

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[406] *Id.* ("A particular example of CBDC would be *account-based* if its issuing central bank were to book it in accounts that third parties would hold with it, as issuing central bank, and if the latter were to also centralise, in its books, the process of its transfer (meaning that legal finality of payments in CBDC woud be achieved *centrally*, at the instance of the issuing central bank, which would thus assume responsibility for providing payments to payors and payees. ").

[407] *See* CENTRAL BANK DIGITAL CURRENCIES, *supra* note 342, at 4 ("[B]alances in reserve accounts and most forms of commercial bank money are account-based.").

[408] Hossein Nabilou, *Central Bank Digital Currencies: Preliminary Legal Observations*, at 17 (Jul. 30, 2019), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3329993 [hereinafter PRELIMINARY LEGAL OBSERVATIONS] ("In contrast, value-based CBDC would be in the form of digitally stored tokens or units stored in the e-wallets of holders, but its transfer would be conducted and finalized in a decentralized or P2P fashion.").

[409] *Id.* at 20–22 (indicating that value-based CBDC may have the same degree of anonymity as banknotes); *See also* Mersch, *supra* note 21 ("Anonymity towards the central bank can be achieved … with value-based DBM.")

[410] *See* DIGITAL INNOVATION IN FINANCIAL SERVICES, *supra* note 95, at 195 (listing various design elements of CBDCs). Thus far, it seems that two competing models in the form of proposals on the design features of CBDC have emerged. They include CAD-coin model and Fedcoin model. CAD-coin is issued on a permissioned blockchain and is intended to be used for wholesale payment services. This coin would be fully backed by cash collateral and will function as a settlement coin to be used by designated entities on a distributed permissioned platform which is linked to a central bank Real Time Gross

The use of blockchain or DLT would not be necessary for CBDC, as is the case with the E-Krona project of the Riksbank.[411] The main difference between CBDC and other existing cryptocurrencies is that there is a level of centralization in any CBDC.[412] In account-based CBDC, both issuance and settlement of the CBDC remains centralized, whereas in value-based CBDCs, the settlement leg may remain decentralized, but the issuance and destruction of money would remain centralized.[413] As it is likely that the blockchain technology for decentralization purposes will not be used in the design of the CBDC, the CBDC will not bear any resemblance to the existing cryptocurrencies.[414] In addition, as DBM already exists in the form of bank reserves (commercial bank deposits with central banks) which is used for wholesale settlements, the need for wholesale CBDC remains doubtful.[415] Although the main advantage of CBDC is in its stability, the geographic limitation and dependence to a single issuer (central bank) would pose limitations to its promise in the absence of interoperability arrangements between various CBDC infrastructures.[416] In addition, at

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Settlement (RTGS) system. On the contrary, Fedcoin is a retail payment medium, issued on a permissionless ledger, while the central bank retains the sole authority to create and destroy coins. For more details, *see id.* at 196 (differentiating Fedcoin and CAD-coin models)

[411] *See* RIKSBANK REPORT 2, *supra* note 96, at 36 (stating that CBDCs can use different technologies, not just DLT).

[412] PRELIMINARY LEGAL OBSERVATIONS, *supra* note 412, at 17 ("Accordingly, issuing CBDC is not in line with the original vision of the invention of cryptocurrencies as neither the promise of trust minimization nor decentralization is likely to be achieved in CBDCs. In this respect, CBDCs would bear no resemblance to cryptocurrencies such as bitcoin.").

[413] *Id.* (citing Morten Bech & Rodney Grarratt, *Central Bank Cryptocurrencies*, BIS QUARTERLY REV. (2017)).

[414] *Id.* ("Accordingly, issuing CBDC is not in line with the original vision of the invention of cryptocurrencies as neither the promise of trust minimization nor decentralization is likely to be achieved in CBDCs. In this respect, CBDCs would bear no resemblance to cryptocurrencies such as bitcoin. As such, its discussion under the rubric of cryptocurrencies would remain misleading, and a more appropriate term for such digital currencies would be (centralized) digital currency or cash.").

[415] *Id.* ("Additionally, as there is already DBM in the form of commercial banks' deposits with central banks for the purposes [sic] of wholesale settlements, the need for issuing CBDC for wholesale purposes remain questionable.").

[416] *Id.* ("[T]he main advantage of CBDC over other cryptocurrencies lies in its stability. However, in the absence of interoperability arrangements, such

a global scale, in the absence of a fiat-based global currency, CBDCs can only be considered stable in relative terms because their value will be volatile in foreign exchange markets.[417]

Due to limitations of space and the variety in the design features of CBDCs, this Article cannot further study the impact of CBDCs on price stability, monetary policy, payment systems, and banking and financial stability. The following section only studies the impact of the CBDC on banking and financial stability, efficient allocation of financial resources, and on the ECB's monetary policy.

C. Impact on Banking and Financial Stability

One of the main concerns about CBDC is that issuing such a currency would substantially transform the funding structure of the balance sheet of commercial banks.[418] This would happen as introducing CBDC would encourage depositors of the banking system to move the balances in their transaction accounts with their commercial banks onto the central banks' balance sheet.[419] This could materialize because, unlike the deposits with commercial banks that carry counterparty risk, the deposits with central banks are risk free.[420] Therefore, if commercial banks would not be able to provide appropriate compensation to their consumers for the extra counterparty risks embedded in CoBM, depositors would have no incentive to hold deposit accounts with commercial banks.[421] As the level of customer deposits dwindles in the commercial banks, they would be more likely to become increasingly reliant on the less stable wholesale funding markets

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stability comes at the price of its geographic limit and its attachment to a single central bank.").

[417] PRELIMINARY LEGAL OBSERVATIONS, *supra* note 411, at 18 (stating that, unlike "bitcoin, in the absence of a fiat-based global currency, such as the proposed Bancor envisioned by Keynes, CBDCs would only enjoy stability in relative terms as … their value would continue to float against one another in [F]orex markets.").

[418] *Id.* at 18 ("One major concern about issuing CBDC would be that it would move substantial parts of the balances in the transaction accounts of the commercial banks' customers onto the central banks' balance sheets.").

[419] *Id.*

[420] *Id.* ("[W]ith the introduction of CBDC, if a commercial bank cannot compensate its customers for the extra counterparty risk inherent in CoBM, there would be no reason to hold balances with a commercial Bank.").

[421] *Id.*

bearing higher interest rates.[422] This would in turn intensify the maturity mismatch and would further increase potential liquidity problems in the commercial banking sector.[423]

Moreover, issuing CBDC may give rise to banking sector instability in times of crises.[424] As the CBDC accounts with central banks are perceived to be risk free, at the very early signs of financial crises, it is likely that the depositors would move their deposits from their commercial bank accounts to their accounts with central banks.[425] In other words, it is likely that issuing CBDC would facilitate runs on commercial banks.[426] Therefore, as the CBDC may result in banking

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[422] *Id.* at 18 (citing John Barrdear & Michael Kumhof, *The Macroeconomics of Central Bank Issued Digital Currencies* 9 (Bank of England, Staff Working Paper No. 605, 2016, ("[U]pon the introduction of CBDC a substantial portion of retail transaction balances might be expected to switch from bank deposits to CBDC, thereby leaving a larger portion of bank financing dependent on the wholesale market, at higher interest rates.").

[423] *Id.* ("Deprived of customer deposits, commercial banks are likely to become highly dependent on the wholesale markets with higher interest rates and less stable funding (short-term maturities), intensifying the maturity mismatch and liquidity problems in the banking sector.")

[424] *Id.* ("In addition, issuing CBDC may result in the banking sector instability, especially in times of crises, where the depositors switch deposits from their commercial bank accounts to their CBDC account with central banks, facilitating a run from bank deposits to the safety of the CBDC.") (citing COMMITTEE ON PAYMENTS AND MARKET INFRASTRUCTURES, CENTRAL BANK DIGITAL CURRENCIES 16 (Bank for International Settlements 2018)).

[425] *Id.*

[426] *See* CENTRAL BANK DIGITAL CURRENCIES, *supra* note 341, at 2 ("A general purpose CBDC could give rise to higher instability of commercial bank deposit funding. Even if designed primarily with payment purposes in mind, in periods of stress a flight towards the central bank may occur on a fast and large scale, challenging commercial banks and the central bank to manage such situations."). It is also argued that this cannot be an obstacle for introducing CBDC. *See* Kumhof & Noone, *supra* note 32, at 35 (stating that "runs on individual financial institutions, or system-wide runs from bank deposits into cash, are as feasible in a world without CBDC as in a world with CBDC, and given the advantages of CBDC in case it comes to a bank resolution, may be less likely with CBDC.") *See also* Barrdear & Kumhof, *supra* note 32, at 14–15 (indicating that a bank run from traditional banks deposits to CBDC is a "potential concern").

disintermediation in normal times[427] and a destabilizing flight to quality in distressed times,[428] such a policy would not amount to a socially optimal outcome in the long run.

It is worth highlighting that the destabilizing impact of CBDC on commercial banks would ultimately depend on the specificities and design features of a given CBDC. If issuing CBDC results in the disintermediated public access to central bank balance sheets,[429] and no specific remedies would be provided to counter its negative impact on commercial banks, issuing CBDC is likely to result in destabilizing consequences for the commercial banking sector.[430]

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[427] See Kumhof & Noone *supra* note 32, at 35 (stating that "runs on individual financial institutions, or system-wide runs from bank deposits into cash, are as feasible in a world without CBDC as in a world with CBDC.")

[428] PRELIMINARY LEGAL OBSERVATIONS, *supra* note 411, at 17 ("This might not be a socially optimal outcome as it would amount to commercial banking disintermediation in normal times and a 'destabilizing flight to quality' in distressed times") (citing Ben Broadbent, Deputy Governor of Monetary Policy of the Bank of England, Speech at the London School of Economics: Central Banks and Digital Currencies (Mar. 2, 2016);Yves Mersch, Member of the Executive Board of the European Central Bank, Speech at the Official Monetary and Financial Institutions Forum: Virtual or Virtueless? The Evolution of Money in the Digital Age (Feb. 8, 2018)).

[429] Barrdear and Kumhof define CBDC as "a central bank granting universal, electronic, 24x7, national-currency-denominated and interest-bearing access to its balance sheet." *See* Barrdear & Kumhof, *supra* note 32, at 7. In this view, issuing CBDC would automatically mean direct public access to central bank balance sheet. *See* Barrdear & Kumhof, *supra* note 32, at 7 (defining CBDC as "universal … access to [a central bank's] balance sheet"). For more details on public access to the central bank balance sheet and its consequences, see Morgan Ricks, John Crawford & Lev Menand, *A Public Option for Bank Accounts (or Central Banking for All)* 1 (Vand. L. Res. Paper 18-33, 2018), https://ssrn.com/abstract=3192162 (proposing that the general public receive access to central bank accounts).; Lev Menand, John Crawford & Morgan Ricks, *Central Banking for All: Reply to Objections*, U. OXFORD FAC. LAW: OXFORD BUS. L. BLOG (Aug. 27, 2018), https://www.law.ox.ac.uk/business-law-blog/blog/2018/08/central-banking-all-reply-objections [perma.cc/AY56-J2NE] (proposing public access to bank accounts at the Federal Reserve); Ricks, *supra* note 21, at 766 (discussing public access to central bank transaction accounts).

[430] Kumhof & Noone, *supra* note 32, at 31 ("[I]f households and firms wanted to quickly shift out of bank deposits at scale, they could do so . … This however would open the door to aggregate bank runs, with a counterpart in the central bank becoming a large, and potentially partly unsecured, creditor of the banking system.").

As the introduction of CBDCs would have a significant impact on the business model of the commercial banking sector, banks should also adapt to the new developments and evolve according to the changing nature of the financial environment.[431] Otherwise, it is highly likely that developments such as introducing CBDCs would risk banking stability.[432] Needless to say, such a result is inimical to the ESCB's statutory mandate to contribute to "the smooth conduct of policies pursued by the competent authorities relating to the prudential supervision of credit institutions and the stability of the financial system."[433]

D. Impact on the Efficient Allocation of Financial Resources

Under the current central banking and banking law framework, only credit institutions, public entities, and certain other market participants have access to the balance sheets of the ECB and NCBs.[434] Therefore, save holding cash, the general public has only an intermediated access to the ECB's balance sheet.[435] However, the introduction of CBDC can lead to a direct public access to the balance sheet of central banks.[436] Although there are historical precedents for such a disintermediated access to central bank balance sheets, as the Bank of England and the Sveriges Riksbank used to allow natural persons to open private accounts, such practice came to an end due to practical

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[431] *See id.* at 31–32 ("[A]ll that is need is that there is a market where bank deposits can freely be traded against CBDC and CBDC eligible securities, and that this market clears through a mechanism other than adjustments in an exchange rate between bank deposits and CBDC. Whether commercial banks participate in such a market is a business decision, not a design feature of the monetary system.").

[432] Mersch, *supra* note 21 (discussing potential impacts of different options for offering CBDC).

[433] TFEU art. 127(5).

[434] ESCB/ECB Statute, *supra* note 48, art. 17 ("In order to conduct their operations, the ECB and the national central banks may open accounts for credit institutions, public entities and other market participants.").

[435] Bech & Garratt, *supra* note 31, at 57 ("Currently, one form of central bank money—cash—is of course accessible to everyone, while central bank settlement accounts are typically available only to a limited set of entities, mainly banks.").

[436] Bordo & Levin, *supra* note 2, at 7 ("[A]n account-based CBDC could be implemented via accounts held directly at the central bank.").

considerations.[437] As such a disintermediated access would decrease the amount of bank deposits, the bank's capacity for making loans—under the fractional reserves theory of banking—would significantly be diminished.[438] As making loans by commercial banks is equivalent to decentralized money (credit) creation, any disruption to this function resulting from disintermediated public access to central bank balance sheets may lead to centralization of credit allocation.[439] Such an outcome would pose a risk to the efficient allocation of credit in the economy and may undermine "the principle of an open market economy with free competition" enshrined in the article 127 of the TFEU and article 2 of the ESCB/ECB Statute.[440]

E. A Need for Increased Accountability of Central Banks

Cash as a medium of exchange has recently come under intellectual attack.[441] In addition, the rise of more convenient electronic payment instruments has triggered a move towards a cashless society,

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[437] Bordo & Levin, *supra* note 2, at 7–8 ("[I]ndividuals and nonfinancial firms held accounts at the Bank of England and the Sveriges Riksbank; during that era of paper bookkeeping, however, maintaining a large number of private accounts became increasingly impractical, and hence such accounts were eventually discontinued.").

[438] Ricks, Crawford & Menand, *supra* note 433, at 22 ("Some might suppose that, because banks' average cost of funds would rise, banks would raise their lending rates, increasing borrowing costs in the economy and decreasing the quantity of bank loans."); *see also* Ben O'Neill, *The Lender of Last Resort: A Comparative Analysis of Central Banking and Fractional-Reserve Free Banking*, 5 LIBERTARIAN PAPERS 163, 169 (2013) ("The fractional-reserve arrangement is an implication of the fact that banks lend out part of the deposits given to them by their depositors.").

[439] Ricks, Crawford & Menand, *supra* note 432, at 20 ("[T]he central bank could end up dominating these markets, pushing asset prices around and distorting credit allocation.").

[440] TFEU art. 127(1); ESCB/ECB Statute, *supra* note 48, art. 2; *see also* Mersch, *supra* note 21 ("Even in the absence of a crisis, readily convertible [CBDC] could completely crowd out bank deposits—putting the existence of the two-tier banking system at risk. In this situation, the efficient flow of credit to the economy would likely be impaired. ").

[441] KENNETH S. ROGOFF, THE CURSE OF CASH 1 (2016) (arguing that "the time [has] come for advanced-country governments to start phasing out paper currency (cash)").

which adds to the complexity of introducing CBDC.[442] Although the arguments for abolishing cash are less convincing than they appear at first blush,[443] digital transformation in payment systems and instruments appears to be inevitable.[444] Cash has traditionally been the only means for the general public to have direct access to central bank balance sheets.[445] However, if issuing CBDC would entail abolishing cash and prohibiting the use of other forms of privately issued money equivalents (such as cryptocurrencies), the Zero Lower Bound (ZLB) constraint on monetary policy would effectively be removed.[446] The positive side of this development is that it provides effective tools for central banks in the conduct of their monetary policy.[447] However, on the rather negative side, it would de facto empower the central banks to slash the amount of users' CBDC deposits with the central bank,

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[442] Ricks, Crawford & Menand, *supra* note 432, at 4–5 ("Modern telecommunications and information technology—including the internet, mobile communication networks, payment card terminals, and smartphones—have made physical payment media less and less relevant to everyday transactions.").

[443] Henk Esselink & Lola Hernández, *The Use of Cash by Households in the Euro Area* 56, (Eur. Cent. Bank, Occasional Paper Series No. 201, 2017), https://www.ecb.europa.eu/pub/pdf/scpops/ecb.op201.en.pdf ("Despite numerous articles claiming a cashless society is imminent, it appears that the use of cash at [points of sale] is still robust in most euro area countries."); Yves Mersch, *Why Europe Still Needs Cash*, PROJECT SYNDICATE (Apr, 28, 2017), https://www.project-syndicate.org/commentary/europe-new-cashless-payment-methods-by-yves-mersch-2017-04?barrier=accesspaylog, *reproduced at* EUR. CENT. BANK, https://www.ecb.europa.eu/press/key/date/2017/html/ecb.sp170428.en.html [perma.cc/9PRF-NDWZ] ("[T]he arguments for going cashless do not withstand scrutiny.").

[444] ROGOFF, *supra* note 444, at 208 ("For the foreseeable future, … the best system is one in which a government-issued currency is the unit of account, though of course it will eventually morph into a fully electronic one.").

[445] Bech & Garratt, *supra* note 31, at 57 ("Currently, one form of central bank money—cash—is of course accessible to everyone, while central bank settlement accounts are typically available only to a limited set of entities, mainly banks.").

[446] Bordo & Levin, *supra* note 2, at 12–13 ("[P]aper currency poses a significant constraint on the central bank's ability to cut its policy rate in response to severe adverse shocks. … That constraint on monetary policy could be eliminated. … With such arrangements in place, monetary policy would no longer be constrained by an effective lower bound on nominal interest rates.").

[447] *Id.* at 13 ("[T]he interest rate on CBDC could serve as the primary tool of monetary policy.").

similar to the negative interest rate policy.[448] Despite the fact that negative interest rates have been currently effective in economies where cash is used widely,[449] the mere existence of alternatives to CBDC would create an effective lower bound and would constrain a given central bank's ability to dive deep into negative territory.[450]

Moreover, one of the main advantages of physical cash is that it grants users "irrevocable access to the payments system."[451] However, an account-based CBDC would make it easier for central banks or other central authorities to revoke the legal and natural persons' access to FMIs.[452] This would warrant more deliberation about the financial inclusion concerns before introducing CBDC.[453] In the current payment systems in Europe, the Payment Accounts Directive (PAD)[454] has partly addressed the risks to financial inclusion. However, this directive may not be currently applicable to payments made by CBDC. If the CBDC is to be introduced, it is of utmost importance to make appropriate amendments to this directive to make sure that access to CBDC falls under its scope of application. Otherwise, issuing CBDC would grant de facto censorship and exclusionary powers to the state vis-à-vis individuals, in particular, if the issuance of an account-based CBDC would entail the abolition of cash and prohibition of

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[448] *Id.* at 16 ("In particular, policymakers would be able to push market interest rates below zero in response to a severe shock.").

[449] Mersch, *supra* note 446 ("[N]egative interest rates have worked.").

[450] Prasad, *supra* note 32, at 19 ("[T]he nominal zero lower bound … would no longer apply. The central bank could institute a negative nominal interest rate . … In an economy with physical cash, this should in principle not be possible since consumers (and firms) always have the alternative of holding physical currency banknotes, a zero nominal interest rate instrument.").

[451] J.P. Koning, *The Big Problems with Big Denomination Bills*, CATO UNBOUND (Aug. 7, 2018) https://www.cato-unbound.org/2018/08/07/j-p-koning/big-problems-big-denomination-bills [https://perma.cc/3D8J-84X7]

[452] *Cf.* Bordo & Levin, *supra* note 2, at 7 (suggesting "an account-based CBDC could be implemented via accounts held directly at the central bank"(footnote omitted))

[453] *See id.*

[454] Directive 2014/92/EU of the European Parliament and of the Council of 23 July 2014 on the comparability of fees related to payment accounts, payment account switching and access to payment accounts with basic features 2014 O.J. (L 257), 214, 224–25 ("A review of this Directive should be carried out five years after its entry in to force … [and] should also include an assessment of the effectiveness of existing measures and the need for additional measures to increase financial inclusion and to assist vulnerable members of society in relation to over-indebtedness.").

other cryptocurrencies.[455] Therefore, it seems that the risks associated with the introduction of CBDC as well as the new powers that it furnishes for central banks may require higher levels of central bank public accountability, appropriate safeguards, and standards of judicial scrutiny.[456]

Physical cash is the main mechanism that facilitates the use of currencies, such as the USD and the euro, as the backup to the global monetary system.[457] As these currencies are used as a store of value and a fail-safe option outside their own country of issue or currency area, issuing CBDC to replace physical cash would jeopardize these currencies' role in the global payments and monetary systems, a policy concern that should not be overlooked in the decision of whether or not to issue issuing CBDC.[458]

To recapitulate, in addition to potential transitional risks and various technical issues, depending on its design features, the ECB would face significant legal challenges in issuing CBDC.[459] Unless appropriate safeguards are in place for the protections of uses from the potential abuse of the absence of the ZLB constraint, for the minimization of its potential systemic impact on banking stability, for the efficient and decentralized allocation of credit, and for the protection of financial inclusion and privacy, the introduction of CBDC by the ECB would face potential unsurmountable legal challenges.[460]

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[455] It seems that the proliferation of various cryptocurrencies having privacy features would mitigate concerns about privacy. Therefore, if issuing CBDC were not to lead to the abolition of other cryptocurrencies or cash, it would only be complementary to other payment methods. *See* Bordo & Levin *supra* note 2, at 8 ("In the absence of competition from CBDC, however, such private networks might exhibit increasing returns to scale and become quasi-monopolistic, which might in turn result in rather complex and opaque government regulations aimed at mitigating systemic risk and preventing price gouging of consumers and small businesses." (footnote omitted)).

[456] *Id.* at 19–21 (describing "several salient risks of taking a relatively passive and inertial approach" to adopting CBDC including "[m]acroeconomic instability … [l]oss of monetary control … [s]ystemic risks … [s]usceptibility to severe downturns").

[457] *See* Koning, *supra* note 454, at 228 ("U.S. dollars are not only used by Americans but are also a popular means for foreigners to protect themselves from inflation of the domestic currency.").

[458] *See id.* ("In a sense, cash is society's payments-system-of-last resort.").

[459] *See supra* Part VII.

[460] *See supra* Part VII.

VIII. International Coordination through International Financial Fora

The regulation of cryptocurrencies faces both boundary and border problems.[461] In the first instance, cryptocurrencies are global in nature and it would be difficult for any single jurisdiction to address their potential risks without international cooperation.[462] This means that another venue through which the ECB can engage in the regulation of cryptocurrencies is through its engagement in the international financial fora.[463] In addition, the ECB's tasks both in the area of regulation, supervision and oversight, and monetary policy require certain degrees of international cooperation.[464] Accordingly, the ECB has various types of memberships in the IMF, the Group of Twenty (G20), the BIS, the Organization for Economic Co-operation and Development (OECD), and the Financial Stability Board (FSB).[465]

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[461] Boundary problem, which is a manifestation of regulatory arbitrage, denotes a situation in which there is substitution flow of financial activities towards less regulated activities when the costs of 'effective regulations' make the regulated activities costlier and hence less profitable. *See* Goodhart, *supra* note 207, at 48. For the concept of boundary and border problems, *see generally* Goodhart & Lastra, *supra* note 227 (addressing "border problems" created by discrepancies in financial regulation among entities and difference of law between countries); Markus Brunnermeier et al., *The Fundamental Principles of Financial Regulation* GENEVA REPORT ON THE WORLD ECON. at 67–71 (2009) (assessing the study's proposals for finacial regulation within the framework of the boundary problem); Rosa María Lastra & Jason Grant Allen, *Virtual currencies in the Eurosystem: challenges ahead*, at 13–15 (July 2018), http://www.europarl.europa.eu/RegData/etudes/STUD/2018/619020/IPOL_STU(2018)619020_EN.pdf (addresing border problems within a wider study of the impact of virtual currencies in the Eurosystem).

[462] Goodhart & Lastra, *supra* note 207, at 714 (suggesting in the realm of financial regulation "national regulation alone will not suffice. Global problems require global solutions . ...").

[463] *See* European Central Bank, *International Relations and Analysis,* (Mar. 25, 2020) https://www.ecb.europa.eu/ecb/tasks/international/institutions/html/index.en.html [https://perma.cc/XJS8-8B8N] (enumerating the European Central Bank's current measures of international cooperation including "participating in international efforts to develop rules and best practices to improve financial stability and the efficiency and transparency of policymaking.").

[464] *See id.*

[465] European Central Bank, *supra* note 466 (describing the ECB's international collaborations).

From the above-mentioned international financial fora, the FSB stands out. As promoting international financial stability is the FSB's primary objective,[466] it could function as a platform for monitoring and coordinating the developments in the area of cryptocurrencies.[467] Regarding systemic risk concerns, and given the borderless nature of cryptocurrencies, the FSB, as an international agenda setter,[468] is well placed to monitor the potential future systemic risks of cryptocurrencies.[469] Central banks are expressly eligible for membership of the FSB.[470] Therefore, the ECB and other central banks can play a significant role, though indirectly, in monitoring global developments in the ecosystem and coordinating the international financial regulatory developments.[471]

The international coordination in the area of cryptoassets as related to the regulation and supervision of the banking system to

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[466] FIN. STABILITY BD., ARTICLES OF ASSOCIATION OF THE FINANCIAL STABILITY BD., Art. 2 (2013) ("The Association shall have as its purpose to promote international financial stability. In particular, it has the purpose to further the objectives stipulated in the FSB Charter in its respective current version.").

[467] This is because the FSB is charged with the task of coordinating the work of national financial authorities and international standard setting bodies (SSBs) at the international level to promote the implementation of regulatory, supervisory and financial sector policies. *See* Financial Stability Board, *Standards Setting Bodies in the Compendium*, https://www.fsb.org/work-of-the-fsb/about-the-compendium-of-standards/wssb/ (last visited Mar. 25, 2020) [https://perma.cc/47JY-5Q8L].

[468] CHRIS BRUMMER, SOFT LAW AND THE GLOBAL FINANCIAL SYSTEM: RULEMMAKING IN THE 21ST CENTURY 72 (2d ed. 2015) ("Two agenda setters are especially central to international financial regulation: the G-20 and the newly constituted FSB."); JOHN ARMOUR ET AL., PRINCIPLES OF FINANCIAL REGULATION 619–622 (2016) (discussing the role of the FSB in creating international regulations).

[469] FIN. STABILITY BD., CHARTER OF THE FINANCIAL STABILITY BOARD, Art. 1, https://www.fsb.org/wp-content/uploads/FSB-Charter-with-revised-Annex-FINAL.pdf. ("In collaboration with the international financial institutions, the FSB will address vulnerabilities affecting financial systems in the interest of global financial stability.").

[470] *Id.* at Art. 5(1)(a) ("(1) The following are eligible to be a Member: (a) Authorities from jurisdictions responsible for maintaining financial stability, such as ministries of finance, central banks, and supervisory and regulatory authorities. ...").

[471] *See id.* at Art. 2 (stating the mandate of the FSB to "monitor and advise on market developments and their implications for regulatory policy").

enhance financial stability would largely remain with the Basel Committee on Banking Supervision (BCBS).[472] In this respect, BCBS has ongoing initiatives on quantifying the materiality of direct and indirect exposures of the banking system to cryptoassets, prudential treatment of such exposures and monitoring the development in this area, and assessing their implications for banks.[473]

Despite its shortcomings, the soft-law nature of international financial regulation[474] can serve the international financial fora in addressing the potential concerns about cryptocurrencies, as it can react to incredibly fast-moving and constantly evolving cryptocurrency ecosystem. Such swift regulatory responses would not be possible under the hard-law framework of a specific jurisdiction or international organizations.[475] Relying on the advantages of soft law over the tardier nature of hard law, it is expected that such international cooperation and coordination to grow hand in hand with the developments of the crypto-asset and cryptocurrency markets.[476]

Conclusion

This Article studied the potential risks of cryptocurrencies to the instruments, activities, and entities that fall within the basic and

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[472] *See e.g.*, BASEL COMMITTEE ON BANKING SUPERVISION, STATEMENT ON CRYPTO-ASSETS (Mar. 13, 2019), https://www.bis.org/publ/bcbs_nl21.htm (providing guidance to banks regarding exposure to cryptocurrency assets).

[473] FSB REPORT TO THE G20, *supra* note 351, at 6–7 ("The BCBS's initiatives can be grouped into three broad categories: (i) quantifying the materiality of banks' direct and indirect exposures to crypto-assets; (ii) clarifying the prudential treatment of banks' exposures to crypto-assets; and (iii) monitoring developments related to crypto-assets/FinTech and assessing their implications for banks and supervisors.").

[474] Chris Brummer, *Why Soft Law Dominates International Finance—and Not Trade*, 13(3) J. INT'L ECON. L. 623, 28-20 (2010) ; BRUMMER, *supra* note 471, at 119-120 (discussing soft law as coercive and giving regulators the ability to ignore regulations).; ROSA M. LASTRA, INTERNATIONAL FINANCIAL AND MONETARY LAW 513 (2d 2015) (summarizing disadvantages of soft law including concerns about its legitimacy, slow implementation, and complex and inconsistent regulations). .

[475] Kenneth Abbott & Duncan Snidal, *Hard and Soft Law in International Governance*, 54 INT'L. ORG. 421, 423 (2000) (stating soft law frameworks have many of the benefits of hard law frameworks but are easier to achieve).

[476] *See id.* (listing advantages of soft law over hard law).

ancillary tasks of the ECB over which it has regulatory, supervisory or oversight powers. It found that cryptocurrencies can potentially have direct and indirect effects on central banking. Direct effects mainly concern the risks to price stability and to the conduct of monetary policy.[477] In addition, risks to the central bank monopoly over issuing banknotes and coins are considered as a direct effect because such a monopoly would be instrumental to the conduct of monetary policy and the objective of price stability.[478] In contrast, the indirect effects are those that largely stem from the interface between the banking and payment systems with cryptocurrencies, both of which fall within the scope of competence of the ECB.[479] Accordingly, this Article suggests that the ECB's regulatory measures to address such challenges can take two main forms: i.e., direct and indirect regulatory, supervisory, and oversight measures. Direct measures may include direct *technical* measures and direct *regulatory* measures.[480] Given the ECB's defined mandate and the legal constraints on the tools at its disposal, the ECB would face legal and technical constraints in effectively intervening in cryptocurrency markets directly. Rather, the main venue through which the ECB can take action is through indirect channels using its regulatory, supervisory, and oversight powers over banking and payment systems, which may include setting participation and access criteria for payment and banking institutions with substantial cryptocurrency activities for access to ECB's payment and settlement infrastructures, or within the framework of its comprehensive assessment (AQR and stress testing), establishing a new framework for assessing credit institutions' exposure to cryptocurrencies.[481]

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[477] A FURTHER ANALYSIS, supra note 28, at 33–34 ("Conceptually, virtual currency schemes could have an impact on price stability and monetary policy if they affect the demand for the central bank's liabilities and interfere in the control of the supply of money through open market operations.").

[478] *Id.* at 22 (discussing the goal of Bitcoin supporters to "end the monopoly central banks have in the issuance of money").

[479] *See id.* at 5 ("Virtual currency schemes are relevant in several areas of the financial system and are therefore of interest to central banks. This, among other things, explains the ECB's interest in carrying out an analysis, especially in view of its role as a catalyst for payment systems and its oversight role.").

[480] *See supra* Part III (reviewing potential options for ECB's regulation of cryptocurrencies).

[481] *See* Finck, *supra* note 224, at 682–90 (discussing principles of cryptocurrency regulation); Maupin, *supra* note 125, at 17–18 (proposing national and international regulators to apply existing regulatory regimes to cryptocurrency regulation). *See also* Press Release, Eur. Cent. Bank, ECB starts

At the time of this writing, since cryptocurrencies do not pose a significant risk to the scope of the mandate of the ECB, adjustments or amendments to the relevant primary and secondary legislation governing the ECB and its operations would not be needed, as the indirect tools at the disposal of the ECB are likely to address the potential risks stemming from cryptocurrencies.[482] However, as future developments would render such changes necessary,[483] the Article highlighted some of those potential areas of legal change that the potential wider use and adoption of private cryptocurrencies and potential issuance of CBDC may require.[484]

Given that Bitcoin and other cryptocurrencies are programmable and capable of accommodating various innovative features (e.g., colored coins/smart contracts), an intrusive and direct approach to its regulation would stifle the potential future innovations that would be built upon the Bitcoin protocol layer, some of which may go beyond the field of central banking, money and finance and would be hard to fathom at the moment.[485] Viewing Bitcoin as an evolving open-source, work-in-progress protocol warrants a nuanced indirect and light-touch regulatory approach, which is data dependent, and defers to the virtues of experimentation, spontaneous discovery process,[486] and evolutionary dynamics in the financial system.[487]

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comprehensive assessment in advance of supervisory role, (Oct. 23, 2013), https://www.ecb.europa.eu/press/pr/date/2013/html/pr131023.en.html [https://perma.cc/RAL2-BGGB] ("In addition, the ECB can make use of its supervisory powers within the framework of its comprehensive assessment (asset quality review (AQR) and stress testing) and establish a stricter framework for assessing credit institutions' exposure to cryptocurrencies.").

[482] *See supra* Section 3.3.

[483] For example, the introduction of CBDC, depending on its various design features, would eventually require amendments to the TFEU and other legal tender laws of the EU.

[484] *See supra* Section 7.

[485] KEISTER & SANCHES, *supra* note 397, at 4 ("Within this framework, we interpret a central bank digital currency as a new, technologically distinct type of outside money.").

[486] Israel M. Kirzner, *The Perils of Regulation: A Market-Process Approach*, 119–49, *in* DISCOVERY AND THE CAPITALIST PROCESS (Israel M. Kirzner ed. 1985).

[487] *See* Simon A. Levin & Andrew W. Lo, *Opinion: A New Approach to Financial Regulation*, 112 PROCEEDINGS OF THE NAT. ACAD. OF SCI. 12543, 12543-44 (2015); ANDREW W. LO, ADAPTIVE MARKETS: FINANCIAL EVOLUTION AT THE SPEED OF THOUGHT 365–71 (2017).